Personal Computer World

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FEBRUARY 1980 50p

EUROPE'S LEADING MICRO MAGAZINE

CASE STUDY: MICRO-ASTROLOGY

Roger Elliot charts his way to success

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Finally, before submitting an article, please check it through thoroughly for legibility and accuracy.

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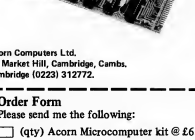

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9 = EXAMINE SALES LEDGER
10 = EXAMINE PURCHASE LEDGER
11 = EXAMINE INCOMPLETE RECORDS
12 = EXAMINE PRODUCE SALES

SELECT FUNCTION BY NUMBER

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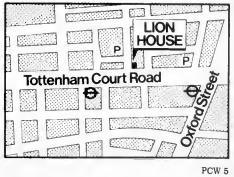

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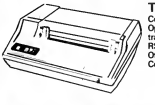

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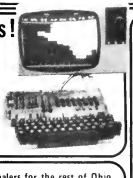

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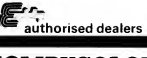

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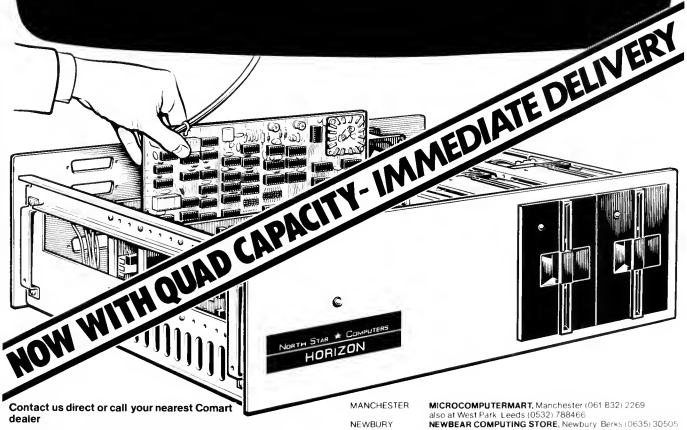

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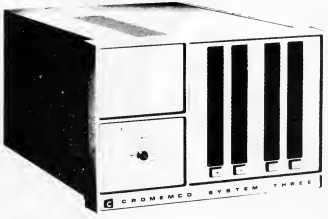

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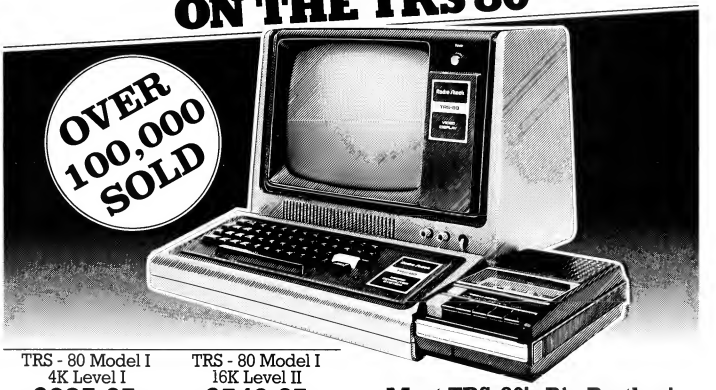

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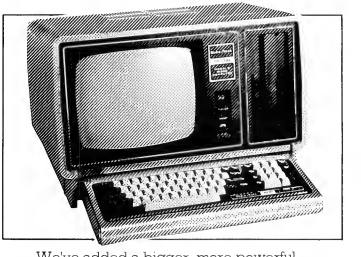

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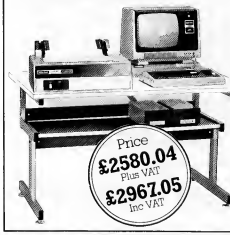

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Part 1. PLANNING: Why Interactive; Planning Use of Resources; Documentation; Designing the Source Language and the User Interface; Executing the Compiler;
Part 2: THE STRUCTURE OF A COMPILER: Filling the Gaps; Description of Terminology and Environment; Source and Internal Languages; Incremental Compiling; Re-creating the Source Program; Levels of Internal Language; True Compilers; Error Checking; Error Messages; Names, Scope and Data Type; Dictionaries and Tables; Storage Management; The Editor; Input and Output; Break-ins; Summary of Design;
Part 3: THE DESIGN OF AN INTERNAL LANGUAGE: Reverse Polish Notation; Operators; Encoding Reverse Polish; A Brief Summary;
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Part 8: SOME ADVANCED AND SPECIALIZED TOPICS: Some Special Compilers; Dynamic Compiling; Summary of the Deadly Sins; References; Index.

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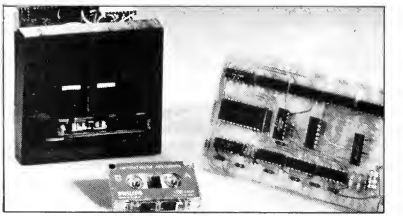

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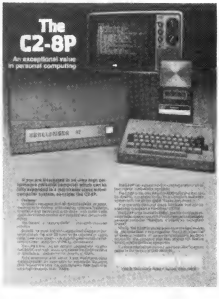

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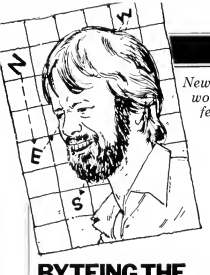


NEWSPRINT

Newsprint is the place where Guy Kewney *reports the happenings of the micro world — read on for product news, rumour, gossip, prediction, speculation and fearless exposés.*

BYTEING THE DUST

The computer retail chain — Byte Shop — is dead: long live Byte Shop (1980). The old trading company is in receivership, and a new trading company, Summary 87 Ltd. has taken over the assets. It was under this arrangement that managing director, Bill Cannings, was suspended from duty and replaced as MD by the accountant he himself had appointed six months earlier — Derek Wetherby.

The reason for the appointment of a receiver was that Byte Shop's major backers, becoming anxious about the future of their investment, called in their money. These backers were the merchant bank of-shoot, Charterhouse Developments Ltd and United Electronic Holdings Ltd and, according to Charterhouse director Richard Strong, both had invested £75,000.

Having said all that, the list of absolute facts that can be written down on paper becomes very short. Indeed Charterhouse's view of events is quite simple: Byte Shop was insolvent, because it couldn't pay its debts as they fell due.

Talking to people inside the group elicits the wide-spread opinion that this was only part of the problem. It seems there was a personality clash between Cannings and Charterhouse and it is said that, because he controlled half the shares, any conflict could never be resolved at board level.

What Cannings' style of management may have lacked is still not clear to Cannings himself, but his friends point to the nature of the problem by referring to what they emphasise as his strong point — sales flair and enthusiasm. By implication at least, they suggest that his control of cash flow was "unsophisticated"... a view supported by his earlier appointment of Derek Wetherby. The crunch came when, depending on your point of view, the company became insolvent, or became "in need of cash to expand".

Part of this expansion was financial... credit for the new generation of customers who were not cash payers. They were local authorities, polytechnics, large companies and they expected to buy and be sent an invoice, and to take their time signing the cheque. And part of the expansion was technical — Cannings had decided to take Byte Shop into software, as he announced last September at the Personal Computer World Show.

It also appears from company figures that there was a problem on maintenance. Say people inside the chain, the problems of servicing the Ohio Scientific range were more than Byte Shop had planned for; a manager of one of their shops has commented that Ohio were slow in supplying components. Charterhouse had offered the cash needed — another £100,000 — but on terms unacceptable to Cannings, for the simple reason that what Charterhouse wanted, to protect its investment, was more control.

Nonetheless, the company is not worthless and prospective buyers are being told to think in terms of £400,000 if they want to buy it. What exactly they might get for their money is not clear... certainly they wouldn't be buying the debts. At press time, at least two large groups, one of them Currys, were known to regard this figure as a sensible basis for negotiations.

No one at the Byte Shop (1980) would talk about it, but our guess is that Charterhouse collapsed the old Byte Shop by calling in a debenture (company morgage). The chain, strapped for capital, was presumably unable to produce the £150,000 needed to pay it off again.

Under the terms of a debenture, Charterhouse could easily appoint a receiver, and this they did; accountancy firm, Stoy Haywood, provided him, in the person of a Mr Marriott.

Marriott was instantly put on the spot by the Press, who asked in round terms whether his appointment was, as many in the industry suggested, an attempt to circumvent the claims of creditors. He denied this strongly and Computer Weekly quoted him as saying: "We are doing our best to protect these claims. The company could be acting criminally if it continued to trade. We have transferred the assets to Summary 87 Ltd, so that the parent company is not trading."

At least one creditor, former publicity man Terry Pettigrew, regards this as ingenuous. "I've been told that if I sue for my money (he's owed around £3,000 worth of fees), Byte Shop — which has no assets at all — will fold and unsecured creditors will get nothing. If we don't sue, then we have been promised a dividend when the company makes a profit, and they say that may not be for two or even three years".

And Pettigrew's opinion of the deal is unique only in his willingness to be quoted: ". . . I may be old-fashioned, but I think that you don't incur new debts until you have paid the old ones, or at least promised to pay them".

The implied conclusion, that Byte Shop may have been undercapitalised but was not going broke, is not based on the figures available to Charterhouse, but on the opinion of unsecured creditors — who are naturally biased. Most of them agree that, for the good of the trade as a whole, it's better that Charterhouse keep the Byte Shop stores going; and they have agreed to continue supplying goods and services to the new company and live in the hope of dividends. It seems that the new company, Summary 87 Ltd, trading as Byte Shop (1980) is transacting business on behalf of the receiver of the old company — and therefore the creditors. It can keep cash coming in, where-as the old company is legally prevented from trading.

The $64,000 question is: if the business is apparently worth somewhere in the region of £400,000, why is it in receivership? Most unsecured creditors will be that much happier when Charterhouse's receiver releases figures — the figures which will show the good reasons for Byte Shop's collapse, beyond the fact that Charterhouse withdrew its finance.

There was no obligation on the bank to keep putting money in. It has acted quite properly as a secured creditor; it was, after all, entitled to demand its money at any stage and leave the company in ruins — and it has not done so. Moreover, as a bank, Charterhouse must protect the interests of its depositers, and this obviously involves putting pressure on the management of a company which it has supported, if that management is causing anxiety.

Obligation or not, it would be a good public relations gesture if Charterhouse were to call a conference and show some figures, and at press time Richard Strong of Charterhouse said he was expecting to be able to show them to creditors "soon". He also said that he couldn't see the unsecured creditors getting £1 in the £1 back. He went on: "I don't know why that's so. . . it simply means that when the company was put into receivership, it was in an even worse state than one thought at the time".

A timetable compiling package from Petsoft: it costs £95, and needs a 32K byte Pet.

NEWSPRINT

"Coo, Bill, I am glad we got this Atari from Ingersol."
"Makes you feel fitter at once, don't Tracey?"
"Yeh. Stimulates the appetite, this sporting life — but enough's enough."
"You fancy a quiet, uh, rest darlin'?"
"Yeh, wot a good idea! You get out the hand-held £17.95 Touch Me game, while I slip out of these sweaty things into sumfink more, you know . . . "

CRA pulls down the Shade

A really useful trade association arises when public outrage at malpractice threatens to close down the business. The most useful trade association is ABTA, which refunds your money if you get taken for a ride by a shyster travel agent; it also finds the criminal and prosecutes him.

Things generally have to be pretty bad before a trade association gets off the ground and, as most of us now know, the computer retail trade has now set up a Computer Retailers' Association (CRA).

Are things really that bad? Are the retailers that desperate? Well, no. Judging by the end of 1979 meeting of the CRA in London, no sense of urgency at all is felt by the retailers of Britain. One of the prime matters under consideration at the meeting was "a full time secretariat". Having noticed that all the good, grand and grandiose ideas generated since April had come to nothing because there was nobody to carry them out, the CRA approached micro dealer Shade, of Calne. Shade came to the meeting, having agreed to accept a fee of £7,500 per year, and to provide a full-time secretary, an office, and a consultant. The job was: to chase members and collect their money. All that remained was for the members to agree.

They didn't. First, they thought that an independent person should do the job. When someone rang up Shade asking for the name of a MicroCobol supplier, where, for example was Shade's name to appear on the list? Second, they felt they should have been consulted first. Third, they felt that a year was too long: a trial period of three months, while other possibilities were considered, would be ideal.

The Shade people were very understanding. They said they understood that they had to provide a telephone — a new one — and letterheading, and office space, and so on and that after three months and £1,875 which wouldn't cover all that, they might well find themselves with a spare line, spare office space, and a lot of waste paper? Forget it.

A decision was postponed till the next meeting, a month or so later (about now).

The lack of any sense of urgency should not be taken by customers as a true indication of the state of computer retailing. The problem that provoked the CRA idea originally, was unscrupulous advertising. "Send us your money, and when we get the systems in, we will send you one, probably without half the memory chips and a vital power supply component." Nobody actually ran such an advert, but to be honest, that's how some of them should have read.

But the main problem today is maintenance. Retailers still complain of the difficulty of selling equipment in the face of cut-price competition from people round the corner who don't provide service. Yet if you ask retailers, even the most expert, most honest, most helpful ones, you will find that they don't know: 1) which machines are most likely to break down after installation . . . 2) which suppliers genuinely offer a warranty . . . 3) what is likely to go wrong with the most popular makes of micro within a day of sale, or within a week of sale, or within a month of sale . . . 4) what monthly charge for a maintenance contract would be fair for the top selling makes . . . and 5) how long it takes to debug faulty hardware and get a new item out to the customer.

You can't sell washing machines like that, and if the CRA does nothing about it, the members will soon find they can't sell computers like that either.

Slip up

There is still time to enter the Computer Advertisement of the Year competition — to be judged at the opening of Computermarket '80 on March 25 at West Centre Hotel. Just as well, as it gives me a chance to observe that Couchmead managing director John Godley is not John Godfrey, and he (Godley) will not be judging the ads himself. Both of these errors were perpetrated in my last Newsprint by a badly aimed editor's pen.

H.P.stand alone

The first purveyor of standard computers to get into the cheap computer market is Hewlett Packard. It's launched a product at the top end of the retail spectrum, at £1,950.

For the money, the customer will get what used to be called the Capricorn, when it was a secret, and what is now called the HP 85. It's a small, light and neat unit, including video screen, keyboard, tape drive, and printer; there's a 32K BASIC interpreter including graphics, and an integral UK standard power supply.

Full details will be revealed when our machine review is completed. For the moment, I am happy to leave the description of the machine as above. The only comment worth adding is that £1,950 is too much, and £1,200 would be more like it. Within a year, that will probably be what Hewlett Packard is asking, too.

The intriguing aspect of the HP-85 is the missing partner on stage. It was expected that this New Year would see the appearance of IBM with a retail computer of similar specs but costing maybe £1,000 more.

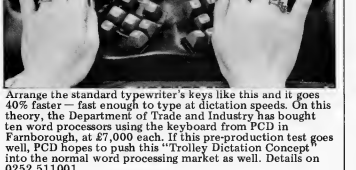
IBM has lost its nerve. It would have to change its nature too radically if it wanted to sell a retail product, and while the writing on the wall says it will have to do so someday, executives would rather put off the evil hour.

Simply summarised, IBM sells computers the way Saville Row sells suits. It isn't the cloth, it's the fit. IBM can cut a computer system to suit a customer because it employs a very highly paid salesman to visit him often, to get to know the company, and to understand the motivations of the buyer — and work on them. IBM would add that it also produces a much more suitable system, but its detractors would deny it.

That just won't work when the product costs £3,000 or less. If it did, car salesmen would try a similar approach — spending a week teaching a prospective customer to drive. They don't.

IBM knows this. It can see Commodore, Texas Instruments, Hewlett Packard and Tandy selling programmable calculators across the counter, and it can see that it needs a similar retail chain carrying IBM before it can sell consumer products in high volume. Unfortunately for IBM and for all of us, the executives who ought to be putting this plan together are the men who were typical IBM salesmen ten years ago, and have been promoted. They understand salesmanship but they do not understand retailing, and they are dragging their feet.

Oddly enough for Hewlett Packard, this is not good news. The HP-85 has come into the market with a price



Arrange the standard typewriter's keys like this and it goes 40% faster — fast enough to type at dictation speeds. On this theory, the Department of Trade and Industry has bought ten word processors using the keyboard from PCD in Farnborough, at £7,000 each. If this pre-production test goes well, PCD hopes to push this "Trolley Dictation Concept" into the normal word processing market as well. Details on 0252 511001.

tag which would have looked very nice to people who were waiting for the IBM 5105 (if that was what it was going to be called). But in the absence of the IBM machine, the only similar computer — packaged in one case, with BASIC and graphics and a tape — is the PET, at a third of the price or less. All the HP offers that PET doesn't, to the first glance, is a thermal printer, and a better quality tape drive.

There's little doubt that HP-85 is better than PET. The question is whether it's three or four times better, and the answer is certainly no. That means the price will come down. When it does, of course everybody will think they are getting a bargain. That's retailing for you.

Forget superpet

Computer makers do not like you to hear of planned new, super machines because naturally they are afraid that you will postpone your purchase of the old, unsuper machines they still have on the shelves. However, anybody who postpones the buying of a PET on the grounds that Commodore is now known to be planning the Super Pet, for launch in the Autumn, will be making a mistake.

Inevitably, a new machine hits the market in ones and twos; the first may be available in September, but "yours" won't come till next April. By then, any number of other new machines will have been announced by any number of other manufacturers; you can wait for ever for the right one. At the moment, according to Printout, the superpet will have a 12 inch screen with 80 columns; it will have more internal memory (up to 64K bytes); and it will probably feature a cheap modem, to allow the machines to talk to each other down phone lines. A big disc drive with 30 million characters of store is planned too, but Printout doesn't expect this until next year.

The "best" version of Star Trek for the PET — the one that won Commodore's startrek competition — is now available on a £10 cassette together with Petopoly, a game of High Finance. Details from dealers.

Heath reshuffle

More astonishing than the news that Heathkit has been taken over, is its claim, at the time of the merger with Zenith, to be number four in the US micro league.

Zenith Radio has taken over the Heath Company from Schlumberger — which itself recently acquired the chip maker, Fairchild. Quite why a group which had just bought into chip making should drop the number four end-user company in the same quarter, is not clear. Certainly rationalisation is planned at the Schlumberger HQ, and one of the results is that Fairchild is being asked to reconsider another operation in the UK — its joint venture with GEC, to build a factory near Liverpool.

As far as Heath goes, the change in this country will be minimal for some time; the name Heath (Gloucester) will give way to Heath Electronics (UK) and micro range items will be called Zenith Data Systems products. Details on Gloucester 29451.

PET W/P

A complete word processing system based on the Commodore PET, costing £2,900, and with software costing only £350, has been released by Dataview of Colchester. It's called Wordcraft, and uses a dual diskette. Details on 0206 78811.

NASCOM1 routines

Instant programs for the Nascom 1 kit: a book of them has been published by Sigma Technical Press.

They aren't programs in the sense of being long accounting, managerial or control suites — they are more like useful routines of the sort that a high level language often provides free, but which a man with only a thousand bytes of useable memory has trouble squeezing in. The examples are not horrifyingly sophisticated, but as an improvement on starting from scratch, it's valuable, for instance, to show how to draw a chess board, how to read a screen character for word processing, how to control interrupts . . . Sigma is at 23 Dippons Mill Close, Tettenhall Wood, Wolverhampton.

Is the PET the best seller it is, because (a) it is cheap and neat; (b) because the company which makes it understands the retail trade; (c) because Commodore marketing chief Kit Spencer is such a straightforward, genial guy, or (d) because the publicity company that promotes Commodore has that little something extra that can make a product take off? If you think the last, you will want to buy the PET systems developed by Stage One Computers for Ilona Uhl (right) to handle mailing, accounting and invoicing, and activities for clients of her publicity consultancy. Turnkey prices start at £3,250 for dual disc, single printer 32K PET and software. Details from Neil Hewitt, Stage One on Bournemouth 295395. Then you can start your own ad agency.

Ohio utilities

Utility software for the Ohio Scientific C1 and C2 range means software that does what the system software really ought to do. It renumbers BASIC statements, searches for variables in a program, and runs the program as soon as it is loaded. All this and more, at prices between £2 and £10, from Mutek in Bath, 0225 743289.

'Tis true

An add-on memory board with 16K bytes for £100 is available from Mike Dennis. It will surprise nobody to discover that I think this is the best value ever to be offered to users of the Comp Shop's UK 101 kit, or the Ohio Scientific Superboard. Mike is, after all, a consultant to PCW, and we wouldn't have anybody on the list who didn't produce superlative stuff. . . .

Mike has also announced a relay control board for these machines. Both his add-ons sit on a 43-way bus, derived from the 40-pin expansion socket on the computers. This, to keep costs down, is a simple piece of Vero onto which fit both memory and relay control boards.

The relay is not for mains switching, the eight relays on the board controlling up to 100V at low power. "I don't approve of having mains on the same board as a micro," commented Mike. The board is latched into the memory map . . . that's to say it's a single byte which can be addressed as if it were a memory location, but instead of storing or recalling the data, it acts upon it.

Details from Blackberries, Sheriffs Lench, Evesham, Worcs WR11 5SR.

Transam Pascal

A new version of Pascal has been picked by Transam, the inventor of the Triton 8080 kit. Instead of going for the version of Pascal offered by University of California at San Diego (UCSD) Transam has decided to offer a version closer to the International Standards Organisation working draft.

Cost will start at £80, and the main point that distinguishes it from UCSD Pascal is the fact that it will run under the CP/M operating system. UCSD Pascal is its own operating system. The language is a compile/interpret version: your statements are condensed to Pcode, and that is interpreted at run time. It occupies 20K bytes of memory and it was written by Keith Frewen of TCL software (a Transam subsidiary).

At the time of going to press, the language was being tested under the Pascal Users Group validation suite, a testing system described in unpleasing terms by Derek Rowe of Abacus. The gist of his remarks was that if it fails the validation, you will know it really is rubbish, because the test will let some strange

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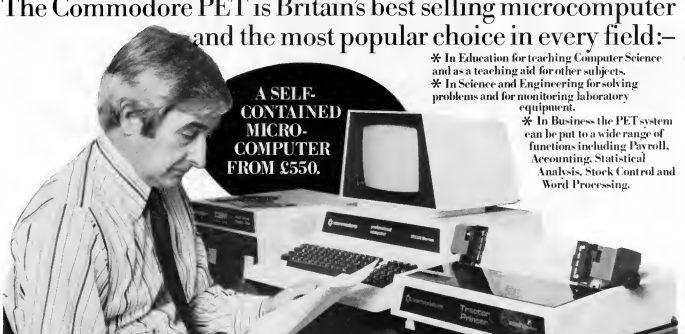

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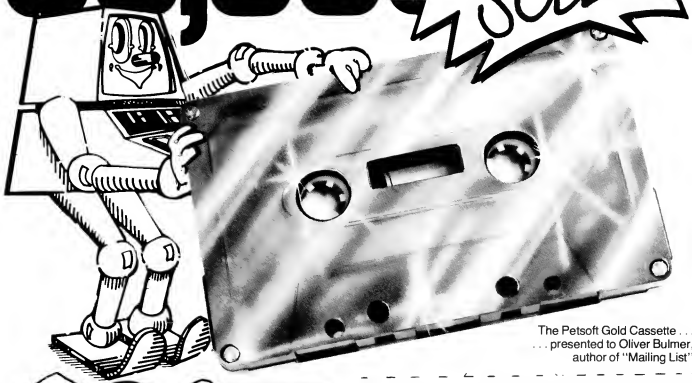

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Kettering. 0536 83922
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Paul Streeter, Sharp marketing boss on this micro, tells me he was "distressed" at my suggestion that only HB Computers had been appointed (two issues ago). The omission of everybody else was deliberate. At the time of going to press, I asked Streeter if he would be prepared to let us have the names in advance of final signing of contracts. "No," he said, "it wouldn't be fair because some aren't tied down yet, and others may pull out. But HB Computers will have the machine at the PCW Show, so I can't stop you mentioning them."

I mention this, not to beat Paul Streeter over the head at the time of his distress, but to make a point. The point is: a month passes between my writing Newsprint, and your reading it. It's still the most up-to-date news you'll get; no use saying: "You can have the information next week," and complaining three weeks later that the information is available, and not published.

Imsai cornered

Imsai agent Corner Computing Store in Epsom has decided it can't make money selling micros, because other people cut the price and run. Graham Jenkins, Corner's boss, has been telling people he is going the way of Byte Shop, but in fact what he is really doing is moving into consultancy. This means telling potential customers what system to buy, and how to use it when they've bought it.

Jenkins has closed Corner Store, and opened Corner Consultancy instead. His partner said: "We have had so many people coming through the door who have bought machines from other suppliers. They found that they didn't understand their machines, and the other suppliers weren't prepared to spend any time helping them."

It doesn't prove anything about Imsai, but it is worth noting in passing that Corner's demise puts the number of companies who have failed to make a profit handling that franchise, to at least three . . . and that number includes the very profitable Comart distribution chain.

Stanley's success

If the retail computer business that is now developing ever wants to pay tribute to its founders, then it had better remember Colin Stanley.

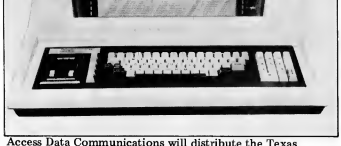
Colin runs HB Computers in Kettering, and he is a founder of and driving force behind the Computer Retailers Association. Sometimes he gives the impression of being the only lucid human there.

But that achievement is not what should make him famous. His glory will be based on a little book that I only had space to mention briefly last month — called "Microcomputers and the Smaller Business". I actually think I could show this to my dentist without fear of frightening him off computers for ever.

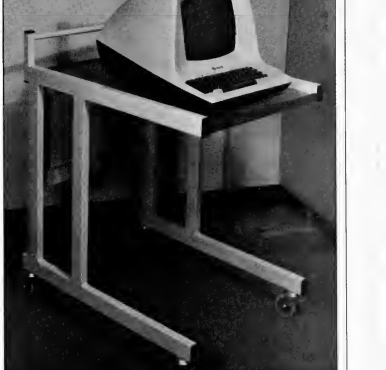
Instead of the typical: "All computers have a central processor which consists of three units — the arithmetic unit which does the actual work of manipulating numbers, the memory which holds the program or operating instructions and certain data, and the controllers which control the transfer of information and instructions between the memory and the other parts of the computer" — all of which tells you nothing unless you knew it already, Stanley's little sales pamphlet is actually written in English. For instance:

"Data. Data is the information you KEEP at present — in ledgers, books, filing cabinets, drawers, even in your head." . . . "The microprocessor actually does the calculations, or selects addresses, (or whatever you're doing). It "borrows" information from the memory bank, "processes" it and then returns the answers to the memory bank." . . . "The main console — where most of the work goes on. You sit in front of it." I'm sure that Stanley's little booklet is capable of improvement. Somebody will do so, one day. But do most of us yet realise that the raw user *doesn't know* that you have to sit down in front of the console? He has some vague idea of feeding a heap of cards into the air cooling vents at the back; but he knows you'll laugh at him if he suggests it, so *he won't ask*.

Keep at it, Stanley.



Access Data Communications will distribute the Texas Instruments model 820 dot matrix printer shown here, under purchase or lease arrangements. Details from publicity agents Span on 0296 624887.

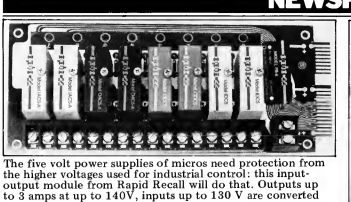


The clever thing about this £108 video display trolley from Data Efficiency is the fact that the wheels will go under an office desk, and the platform will go over it. It means the user can have it "on the desk" without lifting it up and down. It appears with 1500 other accessories in the new DE catalogue — tel 0442 57137.

Sensible

A magazine on micros for education is being launched by our ex-deadly rivals, ECC Publications, which recently sold Practical Computing to IPC. It's called "Educational Computing" and will be published "in association with" IPC and edited by Pat Crabb, formerly of the newsletter (or MUSEletter) of Minicomputer Users in Secondary Education. Naturally you'll think we're sorry to see it appear: we're not. The more information there is about this new business, the better for all of us. And so far, they're not

NEWSPRINT



The five volt power supplies of micros need protection from the higher voltages used for industrial control: this input-output module from Rapid Recall will do that. Outputs up to 3 amps at up to 140V, inputs up to 130 V are converted to micro levels.

making the mistake of pretending that you can do without PCW as well. . . .

Communicator cuts

The "Communicator" board which Mektronic offers as a way of getting inputs into Pet and outputs out, has been drastically cut in price. From £135, the price on the single-page brochure has been amended to £79.

With the Communicator, the user can turn lamps on and off, read thermostats, ring bells, start electric motors, and so on. You'll need another board to switch mains voltages, however. Details on 061-798 0803.

Booze news

The Winemaster is a £6,000 computer . . . "the first of its kind designed specifically for the wine and spirit importer and wholesaler," according to Instar Business Systems in Croydon. It allows "instant control of purchase ledger, sales ledger, nominal ledger . . . and aged debtors."

It is in fact a suite of software programs plus a North Star Horizon micro plus a terminal to run the programs on. Details on 01-680 5330.

Jeprévis

The French small computer firm Logabax is very active (in France) in educational computing. In Britain, it is very active in the orthodox "small business machine" market which it shares with firms like Philips, Olivetti, Nixdorf and the Digital Equipment value-adders.

As an illustration of how computer buyers are thinking, even in this market where the salesman is still king and retail is a seldom-tried novelty, Logabax has published figures for "small business" computers showing that the market will grow by 22% per year until 1988, by which time the total sales will be worth £114 million. That's in the UK. In Europe, the figure will be £2,700 million — according to Logabax's estimate.

At this stage, Logabax doesn't break the figures down into sub-classes. These statistics apply to "single or multi-station disc computers costing less than £35,000". It's obvious that that very broad spectrum covers a range of machines that will never be sold over the counter. In the sub £5,000 range, where Logabax doesn't break down its figures, the company will probably see most of its growth — especially in France. Strangely, this is an area of which the UK branch seems unaware.

Enter RML Algol

A new language for Exidy Sorcerer users "and other Z80 systems with Micropolis discs" is RML Algol. It costs £99 from Liveport of St Ives, Cornwall and they describe it as an extended version of Algol 60 — the extensions being to use disc, and to handle data strings rather than mere items of input and output. Details 0736 798157.

Stock control plus

A system costing £9,950 "including training" has been launched by TDS Business Systems for the purpose of production planning; it's based on the Adds micro-system. The software is the heart of the system, and it will also run on Data General systems.

The crux of the software itself is that it's a very pragmatic stock control system, and beyond the mere storage of statistics. TDS says that it will not only tell the user if an order can be met by a given date, but will also spew forth information on rearranging stock if the answer is negative. That information would include a list of who supplies the parts, who is quickest on delivery, who is cheapest, and so on. Details on Blackburn 662114.

The company that puts the Rockwell Aim 65 flat board computer into this case has decided to branch out on the machine's behalf. Three branches are being provided; they enable the user to pretend that the Aim is a Kim, or a Motorola Exorciser, or even an S100 type computer. The advantage of this is to take advantage of any cheap, used or merely available component boards based on those three architectures. The cost ranges from £80 for the Kim expansion, to £130 for S100 or Motorola interface buses. The company is Portable Microsystems on 0280 702017.

Rair addition

Software for the Rair Black Box micro. The range already offered by Sword Data Systems has been expanded and it now includes an integrated business/accounting system. With hardware, the system is available on rental from £45 per week. Details, Redhill 60980.

Duncan Willis built the Amateur Computer Club's brainchild, the 77/68 microsystem, for £85. He got his printer — an ITT 3330 — from ITT for nothing, as an accolade initiated by the Electrical and Electronic Manufacturers Training & Education Board. It was a good deal for both parties: Duncan had been the star turn on the EEMTEB stand at the Electronics exhibition at Olympia last year.

Other bits

Osborne/McGraw Hill has just published a book called "Some Common BASIC Programs". For just $33 you get the book and an accompanying cassette containing 76 programs covering things like recipe costings, future value of an investment, days between two dates and all sorts of statistical routines. In these days of user friendliness, you may be astonished to find that programs expect you to key in 0 for YES and 1 for NO!!

Best mixed metaphor of the month: "It seems we're barking up a gum tree". This was uttered in the heat of the recent CRA meeting. Latest news is that they are, once again, secretaryless, but all should be resolved on 23rd January.

An unashamed plug for regular contributor, Mike Knight. He will be running a residential weekend course for small businessmen called "The Mighty Micro — Is it for You?". Reasonably priced at £59 plus VAT it offers an introduction to microcomputing from first principles to implementation considerations. It will run from 23rd February in a 4 Star hotel — telephone 0303-892540 for details.

BENCH TEST

THE ACT SYSTEM 800

A late arrival this month — but one that we simply can't afford to ignore — is the ACT System 800. Its importance you'll discover in a moment, but of primary interest is the fact that it offers a growth path for users of Britain's most popular personal computer, the Pet (but, no, it's not a Commodore product). David Tebbutt reports. . .

Julian Allason, the man who founded PETSOFT, went to the USA charged with the task of finding a machine which could be marketed in the UK for at least seven years. There were many contenders for the prize, a substantial deal with ACT Computer Systems — in the USA there is apparently much clamouring for the British market. In the end Compu/Think won with their Minimax system; they claim it to be one of the most advanced microcomputers in today's marketplace. The machine was chosen primarily for its user friendliness, graphics capabilities and minicomputer-like features.

Hardware

The system comprises an operator's console containing the computer, a keyboard and video, plus one or two floppy disc drives, depending on the system chosen. Most business systems will also have at least one printer attached.

Upon closer inspection the console is seen to have an IBM compatible keyboard plus three other keypads — one for screen control, one for numerics and one for those special characters that are usually so difficult to find. The screen control block has full cursor controls plus insert and delete, the numeric pad includes the mathematical symbols and the special pad contains characters like $, (,), <, >, etc. It takes some getting used to, but the effort is well repaid by a high operating speed.

Like the PET, the keys can operate in upper and lower case ASCII or upper case ASCII and PET graphics. The keyboard shift can be locked just like a typewriter. It's also possible to program up to three additional character sets to suit the users' particular requirements.

The 12" screen comprises either 30 lines of 64 characters or a 512 by 240 point high resolution graphics facility. Using the "scroll" option it is possible to hold 120 lines of text in the video buffer with the screen acting as a "window" on its contents.

Field protection facilities are offered — ideal for operator prompts for example — which allow data entry only in unprotected areas. This can have a marked effect on the speed of data entry, especially when used with the automatic skip facility which is also provided. It's even possible to split the screen such that the different parts can operate totally independently of each other. Together with some powerful editing facilities, this must be one of the most advanced intelligent videos attached to a microcomputer.

Moving on to the data storage, it gives the option of 800K Byte(5¼") or 2.4M Byte(8") disc drives. Each drive contains 4 heads operating on two double sided diskettes. It's possible to daisy chain another drive giving a maximum of 4.8M Bytes on line. Serial access of data from disc is very fast due to the fact that this system reads a whole track at a time. Subsequent accesses are then made to the disc buffer, rather than the disc itself. Tests showed that 100 x 250 character records can be written in just over 5 seconds, including file opening and closing.

Industry standard parallel printers can be attached to the printer port without the need for additional interface boxes. And just to complete the picture, it will be possible to buy tailor made desks to house the system. Compu/Think are supplying them and expect to have some in the UK in time for the launch.

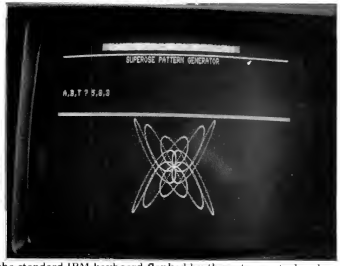
Having seen the visible aspects of the machine, let's now have a look inside. The heart of the system is a 2MHz 6502 processor with 48K user RAM, supported by 16K ROM, 26K video RAM and 16K disc RAM; between them they hold Microsoft BASIC plus graphics and disc extensions, FIFTH, a monitor, MDOS — the disc operating system, disc buffers, video buffers and up to five character sets. In addition to the dedicated disc, video, keyboard and parallel printer ports, the ACT System 800 has one serial and one parallel port. The parallel port has an associated programmable interval timer using 3 pins of the 36 pin connector. The port is driven by an INTEL 8255 programmable peripheral interface giving the options of 3 independent 8 bit parallel input or output channels with handshake capability, or one bidirectional channel with bidirectional handshaking. To the uninitiated, this means that all manner of keyboards, CRTs, D/A and A/D convertors, discs machine tools and even other computers can be attached.

The serial port consists of a National Semiconductor 8250 Asynchronous Communications Element (ACE). This port is typically used for telecommunications or for driving serial printers and it can be programmed to run at anything from 50 to 56,000 baud.

Software

The ACT System 800 contains 8K Microsoft BASIC, surely by now *the* standard for microcomputers. In addition there are two sets of extensions —

TECHNICAL FEATURES	
CPU	6502, 2MHz
Memory	106K total, 48K User RAM, 24K Video RAM, 18K ROM, 16K Disc RAM.
Keyboard	Full size, IBM compatible, numeric, function and special character blocks.
Screen	12" integral, 64x30, 240x512 graphics, up to 3 programmable character sets plus upper/lower case or upper/graphic symbols options, protected fields, split screen facility, up to 4 screens video scroll facility.
Disc Drives	Up to two dual density, dual head, twin drives. 800K, 1.6M, 2.4M or 4.8M bytes
Printers	All standard printers supported.
Ports	Serial and parallel programmable. Will drive modems, printers, discs etc.
System Software	ROM based MDOS, Monitor.
Languages	Microsoft BASIC plus disc and graphics extensions. PL/M, FIFTH, Assembler with 64 user-definable op codes.
PRICES	
808 (800K)	£3950
824 (2.4M Byte)	£4950



Top: the ACT System 800 with its 5¼" disc drive. Above left: the standard IBM keyboard flanked by the extra control pads. Above right: an example of split screen operation.

one to handle the high resolution graphics, the other to handle discs. The graphics instructions set and unset any of the 122,880 points, clear the whole screen and sense whether any point is on or off. The disc BASIC instructions are used to open and close files, read and write disc data, load and execute programs from disc.

Accessing data can be either serial (just like a cassette) or direct, according to the position of the record in the file. In the first case record lengths may vary, but in the second all records must be the same size. This enables MDOS to calculate the position of the nth record relative to the start of the file. A number of direct commands are also available for handling the 'housekeeping' aspects of disc storage. Facilities offered are: disc formatting, essential for unused discs and handy for clearing used ones; disc directory, this displays a list of file names and free space contained on the disc; program saving and loading; program or file erasing; and, finally, a memory reset option.

All the "behind the scenes" work associated with these commands is carried out by the disc operating system — MDOS. It treats each side of each disc independently, holding the directory on track zero and leaving 39(5¼") or 76(8") tracks free for use. All files occupy a whole number of tracks which means that they must be a multiple of 5K or 8K respectively. Not surprisingly, the 8" disc holds a maximum of 76 files per side and the 5¼" up to 39 per side, only one of which may be open at any time. This should not concern the user unduly, but it does mean a certain amount of care must be taken by the programmer. As only one file can be open at a time then the close instruction needs no parameters — thus simplifying the programmer's task. It is interesting to note that one of the manuals gives a diskette a working life of 120 hours. It therefore comes as something of a relief to learn that the disc drive motor is switched off after each operation.

Assembler programmers will be

pleased to learn that this system contains a monitor, has microprogramming facilities and runs the FIFTH language natively.

The monitor has a tiny assembler which can handle all of the 6502 opcodes plus three extras: BYT, TXT and END. BYT and TXT are used to store data — up to 15 bytes or 30 ASCII characters respectively. END is always the last statement in a program. Other features offered by the monitor are a memory dump, a disassembler and a breakpoint facility.

If the full set of 6502 opcodes is insufficient, it is possible to microprogram a further 64 instructions using the opcodes whose two low order bits are turned on, ie those whose LSBs are 3,7,B or F. The advance publicity literature suggests that a good use for this facility would be to perform Pascal. In case that is not enough, a wealth of ROM based routines are available for use by the assembler programmer.

Finally, the FIFTH language has been implemented on this machine. This language has been designed for easy transportability between systems of differing design and manufacture. In order to achieve this, FIFTH is based on the simplest common denominator between computing systems. Portability at last? — yes, but being a low level language it means that development times are likely to be quite long — compared with BASIC, for example. It seems that FIFTH is worthy of an article in its own right; we shall consider this quite seriously.

Potential use

Without doubt this machine is aimed at the business/scientific/education market with the businessman having the additional benefit of several application packages available to him. Knowing the scientific and education markets' preference for developing their own systems this should not come as a shock to them.

Anyone who has invested time and money in developing PET programs will find their investment protected.

Although the transformation requires a little juggling — modifying POKE locations for example — it's minor compared with a system rewrite. ACT intend to have some new utilities which will take care of these minor irritations in due course.

ACT suggest that the system is aimed at all those people who need a minicomputer but who can't really afford one. Certainly, in many respects it competes well — the mix of high resolution graphics, characters, split screen, field protection and a comprehensive keyboard make it as good as, if not better than, many minis.

Perhaps the differences are to be found under the surface — for example at the moment it supports just one user, the disc capacity is limited and file access methods are restricted to relative direct or serial access. But then, these are comparisons with a mini which usually supports multiple use, has disc capacity in tens of Megabytes and whose access methods usually include some form of indexing. Compared with most other micros this machine must be ranked with the leaders.

Attachment of laboratory equipment should pose few problems for the scientific and educational users, thanks to the programmable parallel port.

In the same way communications should be straightforward via the serial port, with its variable baud rate, data handling and modem control functions.

ACT packages available are Sales Ledger, Invoicing, Purchase Ledger, Stock Control and Word Processing. A 'Pagemate' database system is available, which enables the user to store his business information in such a form that he can interrogate the data in various ways and produce reports from the data according to his requirements. Updating facilities are included in the package as well as mathematical and statistical functions which can be applied to the data. This explanation is a gross simplification but I trust that it gives some idea. A Payroll package will be released in time for the new tax year. In addition, ACT will be offering compendia of programs on discs — games, programming aids, utilities, tutorials etc.

Finally, . . games. Of course this machine is ideal for games in the same way that a Lamborghini is ideal for going to the shops. That is not to say it won't happen, it's just that it's unlikely to form part of the decision to purchase.

Documentation

This is one of the best documented systems I have ever come across (in 14 years). Everything is explained clearly in the manuals that I was given — The beginner's guide to Minimax, the Minimax Technical Manual and the Pagemate Database System. One general criticism is that all three manuals would benefit from more drawings. In particular, describing the FIFTH stack handling without pictures is rather like describing a spiral staircase without using your hands.

As well as straight facts, the manuals offer sensible advice. One example is in giving standard names to the multitude of fields which are referred to by the disc operations. Such conventions are obvious to the experienced programmer, perhaps, but the advice is ideal for the novice. The manuals also contain a very light sprinkling of wry humour: "There are a wide variety of unpredictable antics that your equipment will perform if you attempt to use a diskette that has not been formatted" being one such example.

Expandability

At the moment it's difficult to predict how the system will grow. It comes as a fairly complete package with the two programmable ports allowing a fair degree of expansion to the user's requirements. As Compu/Think are working on IMI 11M Byte hard discs, a multi-user system, FORTRAN and BASIC compilers it's not unreasonable to expect some, if not all, of these developments to appear in the UK in due course.

ACT themselves have almost completed an integrated business package comprising order processing, stock control, invoicing, sales ledger, purchase ledger and payroll, all bound together by ACT's own database system. If you buy this package ACT will offer a maintenance agreement by which you receive all system and application enhancements as they are released.

Another possible area of development is that of ROM based software, especially after the success of the PET programmers' toolkit. This, however, is speculation and there are no firm plans for its introduction.

Conclusion

A number of business packages have already been written and, with substantial backing from ACT, — plus 9 regional distributors and dealers throughout the country, all carefully chosen for their experience and engineering support — I cannot see how this system can fail. It's a well made, easy to use product and it gives the PET user a (relatively) easy growth path. It's bound to sell extremely well with the limit likely to be dictated by Compu/Think's production capacity rather than by level of demand.

At a glance

FIRST IMPRESSIONS	
Looks	***
Setting up	*****
Ease of use	****
HIGH LEVEL LANGUAGES	
BASIC	****
COBOL	n/a
FORTRAN	n/a
Pascal	n/a
System Software	***
PL/M	available
PACKAGES	
Business	****
Education	n/a
Home	n/a
PERFORMANCE	
Processor	****
Cassette	n/a
Disc	****
Peripherals	n/a
EXPANSIBILITY	
Memory	n/a
Cassettes	n/a
Discs	***
Bus	***
Ports	****
COMPATIBILITY	
Hardware	***
Software	***
DOCUMENTATION	****
VALUE FOR MONEY	****

*****	excellent
****	very good
***	good
**	fair
*	poor

Benchmark Timings (in seconds)

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8
ACT 800	0.9	4.6	8.5	9.4	10.1	14.9	23.4	5.6
Micromation	1.4	4.4	11.2	11.3	11.5	21.2	34.9	3.9
Z-Plus	0.9	3.4	11.2	10.5	11.2	18.0	28.9	3.7
Cromemco	1.7	4.6	14.9	17.8	19.4	30.2	41.9	22.9
System 3	1.9	5.7	16.4	19.7	21.3	32.4	44.1	22.9
PET	1.7	9.9	18.4	20.4	21.0	32.5	50.9	12.3

COMMUNICATION

PCW welcomes correspondence from its readers. Be as brief and concise as possible and please add "not for publication" if your comments/questions are to be kept private.
Address letters to: "Communications", Personal Computer World, 14 Rathbone Place, London W1P 1DE.

Homebrew notes

Martin Lea's design for a Z80 homebrew has done for the Z80 what the 77-68 did for the 6800. It may not be the first Z80 system of its type, but it is the first I have seen in print.

While not wishing to detract from his design, I feel a few comments may be of interest to Martin and other prospective constructors. These mostly concern expansion of the present design.

1. "All that is needed to interface 16K of dynamic memory is an address multiplexer" is a considerable oversimplification. Although I would agree that the Z80 does make interfacing of dynamic memory much simpler than say the 6800 or the 8080 it still requires at least 5 LSTTL devices and 3 STTL devices, and could not be used at 4MHz with the current design without WAIT states. See the Zilog Application Note "Interfacing 16 pin Dynamic RAMs to the Z80A Microprocessor" for more information.

2. The reset circuit shown (N22, N23) is adequate if only static RAMs are to be used, but must not be used with Dynamic RAMs if data is to be retained after reset. This is because if "RESET" goes low during T3 of an Op-code fetch (M1) cycle then MREQ goes indeterminate about 10 clock cycles later, possibly causing a short or aborted RAM access and destroying data in the RAM (see P.59 of the Mostek MK3880 [Z80] Manual).

3. The minimum memory access time is during an Op-code fetch cycle and is 445nS (not 560nS as stated in the article) at 2.5MHz and 255nS at 4MHz (Zilog Appn. Note). Allowing worst case figures for IC7, IC12, IC6 and IC8 (18, 18, 10 and 26nS respectively) then data could be available a maximum of 321nS (for 250nS memory) or 521nS (for 450nS memory) after MREQ goes low. While typical times for these devices show that they probably will work, "Sod's Law" says that they won't without WAIT states (250nS will be OK at 2.5MHz). WAIT states rather defeat the object of a faster processor and should be avoided if possible.

4. Finally, if it is intended to use the vectored priority interrupt system then the data bus buffer IC7 must have its R/W line pulled low by both M1 and RD since RD is not active during the interrupt acknowledge cycle when the CPU fetches the interrupt vector. This is simply done by "OR-ing" M1 and RD since all M1 cycles are RD cycles anyway (see P.61/62 of the Mostek Manual).

Anyway, congratulations to Martin for having the guts to publish his design. Keep up the good work in 1980, PCW.
I.Caplan, Southgate

Martin Lea replies: Thankyou for your comments, especially point 4 which has revealed an oversight in my circuit. However, your solution of combining M1 and RD will require an additional AND gate in the circuit which will either have to be one of the buffer gates or will require an extra IC. A neater solution is to reverse IC7 so that B0 to B7 are now connected to the MPU. The direction of IC7 (R/W pin 1) is now controlled by WR. During an interrupt acknowledge cycle WR is inactive so the buffer is in the read mode, allowing the interrupt vector on to the MPU data bus.

Cassette cure1

As any PET user knows the most annoying part of loading from Cassette is waiting for the FOUND '- - - - - - - -' message.

This is mainly due to the lack of a tape counter, but even with a counter you would not know if the PET had passed the Program Header. You can sometimes miss the header — wait several minutes — only to find you are on blank tape. My method is as follows:

Connect a Soundbox to the user Port Pin 6 (cassette No. 1 Read). The Soundbox connection is Pin M (CB2 Line).

On both SAVE and LOAD you can then hear the following:

a) 'The Header Tone
b) 'The Header Token
c) 'The Header 'Title'
d) The Program DATA
e) The 'Half Way Point'
f) Second copy of DATA
g) The end of file Token

By using the F.FWD, PLAY and REW keys you can then locate the header on a multi-program tape — Press Play — and wait. If you do not get the message FOUND '- - - - - - - -' at the Header Title stage, rewind slightly and try again. Using this method you can CUE the tape to the right position.

Other advantages are that you can also hear:

a) DROPOUTS
b) CROSSTALK
c) NOISE
d) VARIATION in PITCH due to tight Cassettes.
e) The difference between DATA and PROGRAM tapes.

This is an invaluable aid, and is best implemented by fitting a small toggle switch to the cover of the user port connector. i.e.

Position 1 SOUND (Pin M)
Position 2 OFF (No Connection)
Position 3 CASSETTE (Pin 6)

With Pin N being the 'earth'.

For those who like to keep a 'Working Copy' of their programs in addition to the 'MASTER' a separate cassette is an advantage.

I use an Hitachi TRQ 299 which has an automatic level control (ALC) and a Cue and Review facility. In my case the ALC gives perfect results on the PET recordings every time. The Cue and Review facility allows you to fast wind using Cue to find the 'nth' program on the tape tape.

Position the header using Review and transfer the tape to your PET cassette.

Perhaps somebody will devise a method to convert the PET cassette to 'Cue the Review'.

Incidentally can anybody suggest a method of recovering data from a Program tape, on which the header and part of the first copy of DATA has been erased? (Caused by pushing RECORD instead of PLAY).

R. Cason, Sawbridgeworth, Herts

Cassette cure2

Re Pet Protection in Computer Answers, PCW Dec. '79.

While endorsing everything said by Jon Malone, I find that I can get extra protection by numbering records as they are written on to tape. On subsequent input, read errors are detected by testing the status word. If there is an error, a routine allows the tape to be rewound a little and read again using the record numbers to go back to correct place in the file. I find that a second attempt to read a faulty block often succeeds — whether it involves a data file or a program file. Even so I do keep duplicate copies!
D.S. Skene, Maidstone, Kent.

Revas rollicking 2

The Editor's reply to Mr. Lawson's justified complaint on the delay in printing the Revas program will surely leave readers to draw the following conclusions —

1. PCW are reluctant to publish programs that exceed a few pages of type and any such program listing may or may not be concluded.

2. PCW are under the impression that all Z80 based computers support tape input and have standard formats! i.e. the Editor's comment that the Revas program is "available on tape for a trifling sum". A quick survey of the 'In Store' pages reveals 35 different computers that use the Z80 yet the tape program referred to is only available for the Nascom. The whole point of printing a program listing is to make it transportable and therefore of use to the maximum number of readers.

Perhaps the Editor would reassure at least one of its currently "loyal readers" that the implications of his reply to Mr. Lawson will not be reflected in the magazine's future policy.
D.J. Bullock, Solihull, West Midlands

Good point, we give in. The readers are always right. You can look forward to assembler and machine code programs in future issues — Ed.

Mind your language

I should like to take the opportunity to draw to your editorial attention that someone in your publication seems to have taken a liking to capitalizing the name of the programming language Pascal. I don't know what he or she thinks P.A.S.C.A.L. or PASCAL might stand for, nor do I have much sympathy with the implicit lack of knowledge. However, it is an easy thing to put right, if you will alert your sub-editors.

On page 47 of the December issue you reprinted a set

of eight Basic Benchmarks with a Bench Test of *The Micromation Z-Plus*. In case anyone wishes to run the tests and compare them with a Pascal performance, I have translated the tests into Pascal. I also have a table showing the performance of Berkeley Pascal running under Unix on a PDP-11/34 *(anyone interested in a copy, send SAE to PCW — Ed)*.

The combination of interpretive system, little optimization, and slow processor yields results very similar to those with Basic, which is not surprising. Pascal's motto has never been "do it anyhow, as long as it is fast", but "do it right".

I will however comment in passing that I know some Pascal compilers that generate code for microprocessors that would realize that much of the code in these Benchmarks does nothing, and would delete it. One compiler, I suspect, would reduce them all to two print statements. Comparative results will then be fascinating!

Arthur Sale, Professor of Information Science, University of Tasmania (on leave at Southampton)

Thanks for the Benchtests. The person in our organisation with the "implicit lack of knowledge" points out (most humbly) that he is obviously in good company, as you yourself have referred to Basic — as opposed to BASIC (standing for Beginner's All-purpose Symbolic Instruction Code). With respect to your observation regarding the code in the Benchmarks doing nothing, the same person asks the question: "Is putting a deliberate delay in a program really doing nothing?" Last time we saw him he was walking into the sunset muttering: "COBOL, FOR A = 1 TO 10: NEXT A, ForTran, FOR B = 1 TO 10: NEXT B, AlgoL,. . . " — Ed.

Texas tout

I own a Texas Instruments Programmable 57 calculator, and find the normal instruction manual very useful. However, I do not have much experience of writing programs nor much time to practice the art. I thus wrote to TI at Bedford hoping that the they would be able to supply additional programs for this machine. They have replied to the effect that they do not run programs for the 57 other than those shown in the manual, but they did suggest that your magazine might be able to assist in this matter. I would be grateful for any advice you could give.

J. E. Wynn, Peterborough, Cambs.

Apart from recommending that you read PCW regularly, we appeal to any readers who think they can help to contact J. E. Wynn at 22 Ashridge Walk, Yaxley, Peterborough, Cambs — Ed.

Try this

Readers with the bigger PETS (16K or 32K) might like to try this:

```
5  DATA 1,13,1,26,9,14,7,33
,33
10 FOR I = 1 TO 100
20 X = 6502
30 WAIT X,Y
40 NEXT Y
50 PRINT CHR$(147)
55 FOR I = 33220 to 33228
56 READ Z:POKE I,Z
60 NEXT I
```

Peter Verstage, London WC1

How about VAT

I've been playing with a word processor package, hence this extraordinary product! (The letter is "long and thin"). However, don't worry — I've got a Heathkit Printer on order and I've been promised the indefinite loan of a Daisywheel Printer too, so you or any other of my correspondents won't suffer long. (Well — I might as well put my hard-earned expertise to some purpose!)

I was interested to read J. S. Linfoot's letter in reply to my bit about V.A.T. ("Interrupt" October 1979) You were right — it is an odd letter. He seems to be objecting to the word "luxury" However, you hoped that that column would "stir 'em up a bit", didn't you?

You might want to publish a comment from me, so here goes:

"You've caught me with my pants down, Mr. Linfoot. What can I say? I'm sorry — you are right and I was wrong.

"So, we now have a standard rate of 15% VAT instead of a luxury rate of 15%? I suppose that's OK then — let's all forget it. I suppose that it doesn't matter what we pay as long as it isn't called a luxury".

D.R. Daines, Sutton-in-Ashfield, Notts.

MK14 message 1

In a way of reply to the letter sent by Mr. Clarke (PCW Dec), concerning the problem of displaying messages on the MK14, I enclose a program that demonstrates the way which a word can be shown for short periods of time.

A delay must be set after *each* character is written out so giving a steady line — a delay after all 8 characters would leave the last character slightly brighter than the others.

After the line has been shown once, instead of just doing the whole operation again, we reduce a counter by 1 and test for 00. So we loop round 256 times only — long enough for the message to be noticed, in fact from 1 to 10 seconds depending on the delay value at 0F33. The program displays the message stored backwards at 0F80-7 and then changes it for the message at 0F90-7. This process repeats endlessly.

G. Phillips, London NW9

Thanks for the SC/MP programming pencil! — Ed.

Program To Display Hard Luck on Mk14 Display

Location	Instruction	Hex code	Comments
0F12	LDI 0F	C4 0F	
0F14	XPAH (2)	36	Set up P2 to 0F - -
0F15	LDI 00	C4 00	
0F17	XPAL (1)	31	
0F18	LDI 0D	C4 0D	Set P1 to 0D00
0F1A	XPAH (1)	35	
0F1B	LDI 80	C4 80	Start off at 0F80
0F1D Next	XPAL (2)	32	
0F1F	XRI 80	E4 80	P2 low is 80?
0F20	JNZ PUT-80	9C 04	Not so to put-80
0F22	LDI 90	C4 90	Load 90
0F24	JMP SET-P2-LOW	90 02	Skip a load.
0F26 PUT-80	LDI 80	C4 80	Load 80
0F28 SET-P2-LOW	XPAL (2)	32	Put in P2 low
0F29 DISP	LDI 08	C4 08	Loop 8 times.
0F2B	ST counter	C8 D4	Count at 0F00
0F2D loop	XAE	01	Leave in extn.
0F2E	LDI (2) (E)	C2 80	Load message byte
0F30	ST (1) (E)	C9 80	Store on display
0F32	DLY 01	8F 01	Small delay
0F34	DLD counter	B8 CB	Reduce count
0F36	JNZ loop	9C F5	If not 8 times
0F38	DLD 256-count	B8 C8	back to loop.
0F3A	JNZ DISP	9C ED	Do 256 times.
0F3C	JMP NEXT	90 DF	Endless loop back to Next.

WORKING STORAGE: 0F00 counter
0F01 256-count
START ADDRESS: 0F12

(E) indicates that current value of extension register to be used.

Messages:

```
enter: 0F80 00 00 5E 50 77 74 00 00 'hard'
       0F90 00 00 75  58 1C 38 00 00 'luck'
```

MK14 message 2

In the December issue of PCW Mr David Clarke asks for suggestions for displaying a sequence of words on the Mk. 14.

This letter is intended to give some hints. I wrote a program which displayed three words in succession, left the display blank for a short period, and repeated the routine indefinitely. Before the program is executed, it is necessary to store the segment patterns for the letters of the different words at certain addresses.

It seems easier to explain the program if we take an example. Suppose the message is "HAPPY BIRTHDAY HAROLD". There are only 8 positions in the display. We assume that there are not more than 8 letters in any of the words (if there are less, the segment pattern for the blank positions is "00"). For the first word, we have the arrangement at the foot of this column.

To achieve the display, we shall want to send the segment pattern of 0F12 to address 0D07; of 0F13, to 0D06, etc. The initial letter of the second word will have its segment pattern stored at 0F1A; of the third word, at 0F22.

It may not be essential, but it is convenient, to have a sub-routine for displaying each word. The main program will then have the task of deciding whether it is necessary to have a pause (after the third word). If it is not, it will have to change the address (in the sub-routine)

Continued on Page 100

Address	0F12	0F13	0F14	0F15	0F16	0F17	0F18	0F19
Segment Pattern for	H	A	P	P	Y	(00)	(00)	(00)

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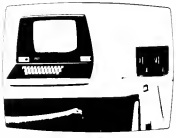

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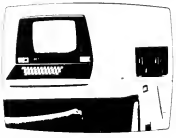

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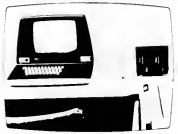

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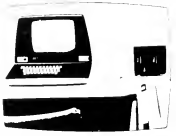

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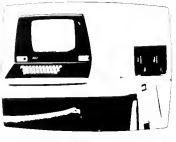

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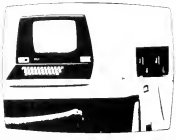

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Steve Shirley, Vice-President (professional) of the British Computer Society (BCS) and Chairman of the F International Group, talked to PCW recently about the Society and its increasing relevance to PCW readers. David Tebbutt reports:

FANFARE FOR THE BCS

From its inauguration some 21 years ago, the BCS is now probably the longest running computing club in the UK. With some 25,000 members drawn from all walks of computer life, it offers a forum for discussion and exchange of information between people interested and involved in the various aspects of computing. Mirroring the rapidly growing interest in personal computing, there are already a number of sub-groups devoted solely to micros.

Branches cover the UK in geographical areas; they are interesected by specialist groups, clustered around specific areas of interst and only occasionally split on a regional basis. For example, a very large number of people are interested in medical computing and a relevant specialist section runs subgroups, meetings and activities all over the country. To a lesser extent, the Committee for the Disabled (originally based in the Home Counties) now has a centre of activity in Manchester, and further centres in Bristol and eleswhere are well past the planning stage.

A specialist group, dealing with personal computing, only requires half-a-dozen affiliate members to be able to set up within the proven guidelines laid down by the Society. It is not the (small) budget available to assist such groups that is important, but the secretarial and support services, the medium for social and technical interchange and the Society's status in the world outside. Says Steve Shirley: "The BCS lays out the welcome mat for everyone involved in personal computing. We feel that the Society has much to offer and can itself only benefit from the involvement of microcomputer buffs".

And apart from affiliate membership, some PCW readers will be technically eligible for the professional member grade — one that is of real, and monetary, value to employers. It's even possible that a few of those amongst us could become Fellows of the Society. Each year about twelve Fellows are appointed by the BCS for their special contribution to the history of computing. But, most important perhaps, the Society welcomes personal computing enthusiasts as affiliates.

Extra benefits include a library which, among other things, is a goldmine for proven algorithms, and a journal — a rather intimidating document, appropriate to a learned society. There's also a whole range of events and functions; for example a computer fair next Summer (run in conjunction with the DOI) and a seminar in March dedicated to high level languages for micros. And for those who are interested, there's a series of examinations by which one can obtain professional qualifications.

PCW readers and the BCS have several areas of mutual interest, two in particular being compatibility and communications. On the former, one time President of the Society, Alex d'Agapeyeff, said at the Thames Polytechnic earlier this year: "People don't want personal computers to be entirely different microboxes. We want a situation where, if yours won't work, you go to the office next door, or the house next door, and you borrow theirs. You are only going to do that if they are the same."

The solution to this problem was invented by one Alan Shearing, well before the era of the hobbyist or even mainframe computing. In the computer pioneering days, he defined the need for a language which could be executed by the machine in the same way, regardless of the equipment used. That idea, originally English, has now been developed in this country by CAP. It is of course their Microcobol.

On communications Steve says: "I should not like to predict the precise impact of personal computing on business from a security point of view. As home computers become more widespread, and it gets easier and easier to attach them to telephone lines, they'll carry potential benefits to users as well as potential threats to large networks containing sensitive information.

"Several known perpetrators of fraud have used home computers to simulate either false input or output, to program routines that determine unknown passwords, or to break into a network and sign on as a legitimate user. Is it therefore any wonder that the BCS is laying down the welcome mat?

"To be more positive, personal computing may well bring desk-top interrogation facilities to the auditor's office, remote from the installation, but able to make dynamic enquiries as a legitimate terminal in a totally authorised fashion. The BCS is much involved in developing 'dynamic auditing' techniques, using non-intelligent terminals."

Various distinguished members of the BCS are active in fields which the layman would consider almost synonymous with personal computing. Jack Cluley, Chairman of the membership board, is himself very involved with micros — mainly their use in industrial applications. Steve Shirley again: "Everyone concerned with education and training — and who can afford not to be nowadays — is committed to making the education system cope with the new technologies. For all aspects of life, working or not, are being pervaded by micros.

"The new hardware is often home-programmer driven and cuts *across* all previous curricula. The BCS recognises personal computing enthusiasts and hobbyists as a very important grass roots movement that's pushing for more knowledge and more information. And it is ready and willing to provide the forum".

If you would like to join the BCS, apply, preferably in writing, for affiliate membership to: *The British Computer Society, 13 Mansfield Street, London W1M 0BP, Telephone 01-637 0471.*

BENCH TEST

HEATH WH-89

For many of us who cut our first multi-core cable on kit products, the name "Heath" still conjures up memories of smoking soldering irons and potting shed electronics — even though at the time one encountered the feeling that somehow their products were a little old fashioned and expensive. Anxious now to lose some of that "kit" image, Heath recently answered the challenge of the chip with a microcomputer designated the WH-89 (H-89 in kit form). Robust and solid looking, the machine divides handily into a CPU/intelligent terminal combination; its intended destination is undoubtedly the increasingly lucrative business market. Carrying out his first Benchtest for PCW, Mike Dennis reports on the relative success of the transition.

Have Heath kept up with current technology. . . and what's more have they found the right price?

Hardware

The Heath WH-89 (shortly to appear under the new logo of Zenith Computer Products) is an all-in-one computer with integral 5¼" Wang floppy disc. It's quite heavy (50lbs) but not too awkward for one person to carry and it's fairly deep (20") and so would, ideally, need a larger than normal desk for comfortable operation. The housing is a two tone grey cabinet with optional green sheet of perspex that flops over the screen. Access to the insides is via a hinged, removable top cover and mounted to this is a cooling fan which, on the review sample, was excessively noisy — Heath say that this is not normal.

The majority of the electronics are carried on two large vertical boards at the rear of the case and any additional PCBs (eg floppy disc controller) plug into the front board. There is space for 6 extra PCBs but since one is already tied up with floppy controller and another for printer interfacing, this leaves four. The VDU screen gives quite a pleasant display although the review sample suffered from a small ripple that "wiggled" through the display and was mildly disturbing.

The general standard of construction was rather mediocre giving an impression of hurried assembly. There is a veritable birds-nest of wires down the RH side, boards and bits sprout everywhere and one capacitor case was perilously close to shorting out the main bridge rectifier — the sticky bit of foam rubber to prevent this event happening had slipped. I would hate to have to repair one.

Heath have only two service centres (London and Gloucester) but can arrange for a servicing contract with Computer Field Maintenance.

System layout

The VDU section is intelligent and has its own Z80, 6845 CRT controller, 3K of RAM and 1K of ROM. There are nine additional function keys and these generate ESC followed by another letter. It is then up to the user's program to detect the appropriate codes and act upon them. In fact, extensive use is made of the ESC key and others to provide a VDU with remarkable flexibility — on screen editing, graphics, direct cursor-addressing etc. These capabilities can, of course, just as easily be used by the computer outputting the appropriate codes.

There is also a separate numeric keypad, but unfortunately I was unable to exit from its alternative set of key values; whether this was due to a genuine fault or the exit routine supplied by the manual, I don't know. Anyway, suffice it to say that with its 80x24 character format (and optional 25th line for system messages etc.), the VDU section is remarkably comprehensive. As the interface to the computer is via an RS-232 circuit, it does mean that you can also hook the WH-89 up to any other computer, as an intelligent terminal.

The computer board again uses the Z80 with 48K of dynamic RAM, 1K of static RAM for the floppy disc and 4K of firmware in ROM. On switch on, you either boot down HDOS or operate at machine code level. Machine code programming is further supported with the inclusion of two disc based utility programs — DBUG and an assembler. DBUG provides general debugging routines (including the ability to set a breakpoint in a loop, execute that loop for n-1 times and then break). Apart from that, DBUG is not particularly memorable.

The assembler also is a bit of an apology for it only accepts 8080 mnemonics and instructions. True, you can bodge it and make it accept the extra Z80 codes but you are still stuck with 8080 mnemonics plus all the hassle of the bodges. What's worse is that the assembler, in common with all the machine code routines, is done using OCTAL!!

To my mind, that decision is indefensible; why Heath stuck to Octal is beyond my comprehension, especially as the CPU is a Z80. If you want to do any machine code development using the Z80 then look elsewhere.

System software

System software comes with HDOS and Extended Benton Harbor (where Heath come from) BASIC (abbreviated to EBHB). HDOS has close affinity to DEC's RSX-11 operating system. . . you can PIP, SYSGEN, mount and dismount discs and set wild cards to your heart's content. The BOOT is a little untidy — you type B (whereupon the computer types "oot" for you!), type some spaces then enter the date (no silly dates allowed — apart from April31st!) and then you are in HDOS. The whole routine takes about 25 secs

Technical Data

Computer	
CPU:	Z80 — 2MHz
Memory:	48K dynamic RAM
Cassette:	Not tested
Disc drives:	One 5¼" WANG
Printer:	Not tested
Bus:	Heath's own
Ports:	via serial I/O cards
System software:	HDOS
	DBUG
	ASM — 8080 only
Languages:	Extended Benton Harbor BASIC
	Microsoft BASIC (MBASIC)
VDU	
CPU:	Z-80
Memory:	3K static RAM
Keyboard:	Standard QWERTY
	Nine function keys
	Separate numeric pad.
Port:	RS-232
VDU:	Reverse video
	80x24
	Optional 25th line
	Graphics

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but you have to be there in attendance and as I was booting into and out of the system quite frequently (of that more later), it all became a trifle tedious. There would appear to be no turnkey facility.

Once into HDOS, you can INITialise, SYSGEN a disc, make a back-up copy and run a very comprehensive diagnostic TEST routine. This includes a head seek test (typically 30ms but the review sample actually achieved 8ms which is good). Since you can SET various parameters, including the seek time, this does provide the user with the opportunity of "fine-tuning" the system to achieve optimum performance. You can set flags for each file, the most notable being LOCK. However there is no UNLOCK command! The only way to unlock a file is to INITialise the entire disc but since this will erase all your other files, it does seem a bit drastic. You can also run a sector check, note down the bad sectors and feed the information in at the appropriate time during INIT. The disc being INITed will make a note not to use them in the future, which makes for a nice feature. You can also ask HDOS for a status report whereupon the number of soft and hard errors and reads and writes made to date are printed to the screen — quite a useful facility. The documentation for this stage does include a first time users path to follow but it's not really obvious what the overall aim of the various stages are; for example, does one always have to SYSGEN every disc? It's not made very clear by the instructions although the 'first time user read here' concept is very good.

The only slight quibble was that sometimes backspace did backspace *and* delete, sometimes it did not (this is one of the many alternative modes of VDU operation that the WH-89 will accept). In fact, in general, I wasn't entirely confident that pressing some keys would produce the same response as the last time if the system had been rebooted or MBASIC entered. One had a feeling that there were one or two little quirks, although this could be partly due to unfamiliarity on my part. So all in all, a very flexible VDU keyboard and DOS.

DISC ACCESS TIMES (in seconds)
Disc Test 2 20.5
Disc Test 3 19.0
Disc Test 4 22.0
Disc Test 5 18.5

Basic

I ran the benchmarks for EBHB and as you can see, they're very, very slow. No information is given as to whether or not you can access the disc using EBHB — I assume not. I didn't think much of EBHB and so looked forward to trying Microsoft BASIC (MBASIC) which was supplied on another disc.

The first disc I tried evoked the error message from HDOS telling me that the disc needed to be SYSGENed first. As it was a so-called distribution disc it does seem a bit daft that it wasn't already done. As it was my only copy, I was rather reluctant to try my hand at SYSGENing for the first time. Nor could I copy the disc as all my Verbatim and "white box" discs yielded a "WRONG MEDIA" error message when I tried to INIT them. Apparently, only Memorex discs seem to work satisfactorily which is great for Memorex but not for the user.

Fortunately, a man from Heath came by bearing another copy and this worked fine — or so I thought. The unfortunate fact was that although both the main system disc and the MBASIC disc purported to have the same issue and version of HDOS, the two were not compatible. Booting up with one disc and trying to use the other always caused the system to "FATAL SYSTEM ERROR", necessitating a complete reboot of HDOS; the repetition began to get a bit tedious.

I was also unable to INITialise any discs using this particular copy of MBASIC and therefore any disc access timing had to be carried out using one which was rather full. As a result any timings would have an unfavourable bias added to them, as compared to a virtually empty disc. To be fair to Heath, the disc was not write protected and so it is more than likely that somehow part of HDOS was clobbered; but I have to tell it how it is.

Booting up HDOS and loading in MBASIC left 21355 bytes free — MBASIC would seem to be therefore about 16K Bytes long. The tables show the available commands and also the benchmark timings. They are improvement on EBHB but still slow when compared with others. Many of the Microsoft facilities are provided plus more besides. Notable features (for one reason or another) are as follows:

The error handling is among the best that I have seen. Virtually all errors can be trapped out — both for type of error and the line containing it. In addition, you can define your own error codes and messages and MBASIC even automatically traps out a non-numeric input when a numerical variable is expected. After the error handling has been "handled", the program can be told to RESUME from whichever line you wish — excellent. As far as numeric variables are concerned, the PRINT USING is rather more easy and flexible to use than some I have seen. You can even embed the PRINT USING format inside text — "I have ## apples" — but you can't use it with string variables.

One small quibble is that it is difficult to print −0.903E+02 . . . the computer prefers to print −.903E+02 which I personally find unclear. PRINT USING with strings is virtually useless as you can either just print the first letter in the string or the first n letters.

RENUMBER did not allow me to renumber a small section by itself in the middle of a program; LISTing does not always insert spaces between reserved words (unlike some other BASICs) and so to maintain readability, spaces need to be included in the statement; which costs a slight overhead in extra memory. The provision of decimal to hex conversion was a very pleasant surprise, mak-

BASIC COMMANDS

Program development

AUTO	REM				
DELETE	RENUM				
EDIT	RUN				
LIST	SAVE				
LOAD	TROFF				
NEW	TRON				

Initialisation and assignment

CLEAR					
LET					
SWAP					

Control structures

CONT	GOTO		ON. . .GOSUB	STOP	
END	IF. .GOTO		ON. . .GOTO		
FOR. .NEXT	IF. .THEN.ELSE		RESUME		
GOSUB	MERGE		RETURN		

Machine level

DEF USR	OUT	POKE			
INP	PEEK	USR			

Input/output

CLOSE	INPUT		PRINT USING	TAB	
DATA	KILL		PUT	WAIT	
DIM	LINE INPUT		READ	WIDTH	
EOF	LSET		RESTORE		
FIELD	OPEN		RSET		
GET	PRINT		SPC		

Functions

ABS	EXP	SGN	ASC		
ATN	FIX	SIN	INSTR	STRING$	
COS	INT	SQR	LEFT$	STR$	
DEF FN	LOG	TAN	LEN$	VAL$	
MOD	RND	VARPTR	CHR$	SPACE$	
			MID$	RIGHT$	

System

ERASE	LOC		RESET	
ERL	LOF		SYSTEM	
ERR	NAME			
ERROR	ON ERROR GOTO			
FRE	POS			

Conversions

CDBL	CVD	HEX$	MKS$	
CINT	CVI	MKD$	OCT$	
CSNG	CVS	MKI$		

ing the use of Octal elsewhere seem even more silly.

The usual arrays can be used, including multi-dimensional string arrays — i.e. A $ (X,Y,Z) — but a slight drawback is that you rapidly run out of reserved string space (as MBASIC doesn't automatically alter the amount of memory reserved for strings dynamically). You get round it by specifying CLEAR XXXX but it's a bit tedious and gives the programmer something else to worry about which to my mind is unnecessary. Numerical variables can either be integer, single or double precision but you can't define them once and for all — you always have to add the suffixes to each variable. The accuracy of the double precision needs improving. For instance, 1.987 ÷ 0.987 yields 2.013171116905303 (work it out!). Only radians are supported by trig functions.

MBASIC has the added bonus of an Editor, which can either be summoned via EDIT (line no.) or entered automatically during RUN when a SYNTAX ERROR occurs. The faulty line number is printed out but not the statement, which is a pity. No clues are given as to the offending portion of the statement and there are virtually no checks for syntax when the statement lines are entered.

The MBASIC disc accessing is fast but fiddly to use. It supports either sequential files or random access; the random access records are fixed length at 256 bytes — a bit of a shame. A FIELD statement will allocate x bytes as A$, the next y bytes as B$ etc., but care is needed with any subsequent references to A$ and B$ and so, normally, any input statements (from the keyboard) are made into X$ and Y$ and then a second statement using LSET A$ =X$ . . . which is fiddly. All numerical variables have to be converted into strings before being stored onto disc, and then reconverted back into numbers when they are read back. You have to remember to do this and it's a chore. One ends up writing about three times as much program as should be necessary. Any number of files can be opened although only one can be open for output.

Having said all that, as the figures show, it's quite respectably fast at storing and retrieving 100 records of 256 bytes and also it is truly "random". A pity then that you can't call for a CATalog of the files on the disc from MBASIC! You have to return to HDOS, CAT and then reload MBASIC. This omission I found rather irritating. However, Heath do say that CP/M will shortly be released; it will be interesting to see what improvements that will bring.

Other languages and software

Apart from CP/M, the only package that Heath have announced is a word-processing package called Autoscribe that's designed to be used with a Diablo printer. Dual 8" disc drives with 1M byte of storage are expected next March. Heath supplied one of their printers for review but forgot to include any ribbon; therefore I couldn't review it.

Some general views of the WH-89. Notice the special function keys on the top row of the keyboard. The insides are easily accessible via a hinged and removable casing. Finally, please note that, just as we started the Benchtest, the Heath company went through a few changes (see Newsprint). The upshot as far as we're concerned here is that the logo on the cabinet has since changed to Zenith Computer Products.

Photography by Ian Dobbie

Business & education potential

It's difficult to give an accurate assessment. Heath would seem to have already realised the business limitations inherent in the single disc concept and the software does make provision for other drives; it would be interesting to look at this machine again when the 8" drives are available. At the moment, business packages are rather thin on the ground — in fact I don't know of any — but hopefully the release of CP/M should solve that. It has many extra facilities that are often lacking on other machines but this can cloud the issue; it may require a greater amount of knowledge to effectively use it. It is not a machine that I could recommend for the beginner.

Documentation

The documentation is very good. The program manuals are well laid out and the indices, most comprehensive. The operation/service manual is also good and provides a useful background to how the computer works. At times, however, the order of presentation is a little peculiar. . . for example, the appendix is in the middle! The blue service manual (not normally supplied) is superb and even provides specifications and data sheets on all the devices used. My only (minor) quibble is the constant reference throughout all the texts and diagrams to U 512, U 608 etc. You have to keep looking up in the tables to see that U512 is really a 74LS74.

PRICES (Excluding VAT)		
16K WH-89	£1490	Assembled
plus serial interface	80	
16K extra RAM	70	
cassette interface	78	
Kit version (H-88) (without floppy disc)	948	
HDOS & EBHB	60	
MBASIC	60	Not supplied with WH-89

Total price of review sample £1830

At a glance

FIRST IMPRESSIONS	
Looks	***
Setting up	***
Ease of use	**
HIGH LEVEL LANGUAGES	
Basic	****
Cobol	N/A
Fortran	N/A
Pascal	N/A
Other	N/A
System Software	***
PACKAGES	
Business	N/A
Education	N/A
Home	N/A
Games	N/A
PERFORMANCE	
Processor	****
Cassette	not tested
Disc	***
Peripherals	not tested
EXPANDABILITY	
Memory	***
Cassettes	not tested
Discs	***
Bus	***
COMPATIBILITY	
Hardware	***
Software	**
DOCUMENTATION	*****
VALUE FOR MONEY	***

*****	excellent
****	v. good
***	good
**	fair
*	poor

Conclusion

The WH-89 is an all-in-one computer that has the added advantage of being usable as an intelligent terminal into a different computer. The VDU section boasts many extra features not normally found, as does the computer itself. It needs to be "intelligently" treated in order to realise its full potential — at which time the "niggles" and minor irritations should take on a different perspective. However, I do have some reservations on the apparent lack of software support for business users.

Thanks go to Heath (Gloucester) — and in particular to Tony Smithson — for help received during the compiling of this Benchtest.

Benchmark timings

Benchmark Timings (in seconds)

	EBHB	MBASIC
BM 1	4.1	2.5
BM 2	17.0	9.2
BM 3	35.0	25.8
BM 4	38.8	26.0
BM 5	44.0	27.0
BM 6	75.8	46.6
BM 7	113.0	73.2
BM 8	11.0	13.0

As PCW has recently received two letters* criticising the Benchtest of the Challenger C3 S1 we feel that we should make a few points clear:

1. All information is based on that provided by the supplier of the review machine. We do, of course, check back with the supplier when encountering any oddities, anomalies or whatever.
2. Our Benchtest is a report of the reviewer's experience with the machine and any other materials and equipment supplied with it.
3. We do not review promises, although we may comment that certain things are on the way. Again, this information is based on that provided by the supplier of the machine.
4. We review a machine against the claims made for it. That is to say that if a machine is claimed to be aimed at the inexperienced user, as many micros are, then we tend to be critical of those aspects which require, for example, the attention of the programmer —Ed.

*The letters came from suppliers of the C3 S1, namely, MUTEK of Corsham, Wiltshire and U-Microcomputers of Northwich, Cheshire.

BOOKFARE

Malcolm Peltu takes as his theme this month, the publishing of a new book from Adam Osborne. It's Osborne's first significant departure from straight fact and marks his arrival in the ranks of the "professional speculator".

Wild and wooly

Adam Osborne has built a powerful reputation as a writer and publisher of lucid textbooks introducing the technical aspects of microelectronics and microprocessors. It is therefore surprising that his first venture into the wider field of the economic and social impact of technology should be a turgid mish-mash of superficial, badly organised and often misleading punditry.

Called *Running Wild*, Osborne's contribution to the Great Microelectronics Debate comes complete with a puff saying that it has been written for the layman — "to educate and help prepare today's citizen for the coming twenty-five years". Even though some of the issues he highlights are of vital significance to the future, the way in which he offers top-of-the-head guesstimates and throw-away observations as if his 'reputation' absolves him from providing analytical justifications to his views makes me reluctant to recommend the book as a preparation for the next twenty-five microseconds.

Running Wild covers terrain that by now should be familiar to a British audience which has recently been provided with an abundance of media coverage on the impact of the dreaded (or eagerly-awaited, according to taste) silicon chip. Yet Osborne concludes, "No one is paying attention to the way in which microelectronics and computers are being used, or to the impact such uses might have on our society. We had better start paying attention, or we will be very, very sorry".

Running Wild seems to have been written by throwing text into a word processor and then joining it together in haste. Open the book at any page and you will find crisply written sentences, racily strung together and apparently making a point clearly. But read sequentially it is tough going because it has little internal structure and rhythm and is frequently contradictory.

For example, Osborne often says that 50% of all current jobs could be eliminated within 25 years, totalling around 50 million jobs in America alone. Yet in the chapter on "The White Collar Future", he states, "But when push comes to shove, microelectronics and automation will *not* have a dramatic impact on office jobs. Fewer secretaries will be needed - but they are in short supply anyway. Fewer file clerks will be needed and low-level office positions may be eliminated. Office jobs will be more demanding, and office personnel will require more education, but there will be no significant decline in the number of jobs".

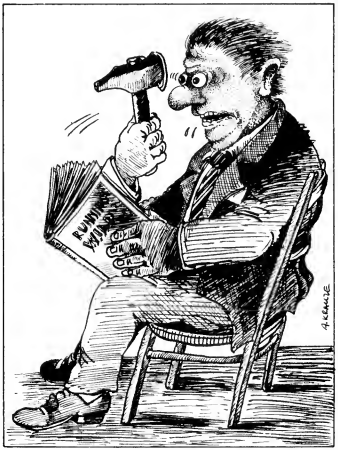
Note the utter certainty with which the statement is made. No ifs, buts or supportive evidence, even though in a different chapter he estimates that almost 45% of all professional, managerial and administrative white collar workers will lose their jobs.

Serious studies of the impact of microelectronics, such as *Automatic Unemployment* by Colin Hines and Graham Searle and *The Collapse of Work* by Clive Jenkins and Barrie Sherman (reviewed in PCW September and October 1979), clearly show that the most revolutionary impact of the technology is likely to be in office and white collar jobs. These have been the under-automated, labour intensive activities which soaked up the unemployment created by the switch away from employment in agriculture and manufacturing industry which has occurred this century.

Unlike *Running Wild*, these other books try to back up their conclusions with some facts and figures. Osborne seldom bothers, even though he acknowledges that he had two 'research editors' to help him. Some of their research appears to extend little further than Prestel publicity puff from the British Post Office.

At the end of the chapter on the white collar future, Osborne does a standard Tomorrow's World-style round up of the way in which computer terminals in the home will enable people to shop, find jobs, book airline tickets, look up electronic news services, etc.

He concludes: "We can argue about the way in which computer terminals will be used in homes and offices, but there is no argument that homes and offices will all have computer terminals. It is already happening - particularly in Europe. The trend in Europe began in Britain with a system called Viewdata, which transmits written material via telephone lines to television sets all over



Britain. Any Briton whose television set is appropriately equipped can read news bulletins or the weather forecast; he or she can buy a variety of products or use various services. In short, he or she can already do most of the things described in the preceding pages".

This gives a misleading impression of the Prestel reality and is just one example of where technological *potential* is confused with technical economic and social reality.

The best parts of *Running Wild* (not surprisingly, given Osborne's background in the microcomputer business) are the early chapters which sketch in the historical development of Silicon Valley, micro games and the emergence of the hobbyist market led by MITS and Altair. In contrast to the rest of the book, these chapters have substance and character, filled with intriguing anecdotal material about the people who, in the heady days of the mid-1970s, started the whole new industry with names like Apple, North Star, Radio Shack, Pet and all those others which now fill the pages of PCW.

Although this material is interesting, it has little to do with the rest of the book, except as an illustration of the new industries the technology can create. To go into detail about the hobbyist market while covering other important areas so superficially is a distortion of the weightings that should be given to a book that claims to be about the next industrial revolution.

These enjoyable opening chapters, one of which is trendily called Roots , are followed by a dreadful chapter on computer intelligence which somehow contrives to turn the exciting subject of artificial intelligence into a boring and detailed plod through the logic used by computers to add numbers together. He does this to try to illustrate the "garbage in/garbage out", our computer-is-a-programmed-idiot principle. There seems little excuse, other than having a handy chunk of text in the word processor, to go into such great detail on such a relatively unimportant topic.

Osborne shows little insight into modern developments in artificial intelligence — such as "expert systems" which are programmed with human reasoning. It is also unclear why the chapter on computer intelligence, containing its heavy-going logic analysis, should come so near the beginning of the book when the more relevant and entertaining description of micro-

BOOKFARE

electronics is confined to an Appendix.

The section I personally find most amazing in this hotch-potch book is where Osborne looks at the three areas in which the applications of computers and microelectronics should be excluded. Aha! I thought, now we can look at some real computer abuses, like the computers in defence systems that nearly caused World War 3 or the invasion of privacy by unwarranted access to medical files or the use of computers by dictatorships to infringe human rights. I was wrong. . . Osborne's three nasties are concerned with three American obsessions - democracy, money and business.

Ban computers from being used to count election results, to transfer money, and in the central operations of stock exchanges, says Osborne. His main concern is that in these three areas, computers can be tampered with to fake the results or commit frauds. This danger, although, of course quite real, applies to most other uses of computers. For someone who later (in the same chapter) goes on to ridicule attempts to regulate computer crime because the laws do not differentiate between illegally producing a Snoopy printout and a financial fraud, Osborne shows barefaced cheek in suggesting glibly that all electronic fund transfers should be outlawed.

Besides being totally impractical - given the bank's investment in computers and the difficulty of monitoring the flow of digital information to see if the transaction is a money transfer, a letter, or anything else - this suggestion also contradicts Osborne's own enthusiasm for home-based shopping, which he believes is so rife in England.

Osborne and his research editors are clearly out of their depth in *Running Wild*. Its glib and crisp style might suit an American public whose minds are incapable of assimilating more than the five-minute gobs of information spat out from their TV sets between advertisements; but, it cannot be considered as a serious contribution to the debate and analysis concerning the impact of information technology, particularly when there is such a substantial and growing range of books that examine the issues with depth and subtlety. *Running Wild* is to these other books as The Beano is to Dickens.

Compiling sins

My original sin was to believe in the infallibility of I, the Programmer. Then I believed in my inherent programming frailty and the Rightness of the Machine. But my faith was shattered by the realisation that the Compiler is not *of* the Machine but is merely mortal software.

That cycle of illusion and disillusion is probably true of anyone new to programming. The first time a program goes wrong, the Virgin Programmer instinctively feels that the machine is at fault, not his or her own perfect logic. After the first debug, however, it becomes evident that the fault lies closer to home.

But I felt a real shock when I first realised that the compiler was not an inherent part of the Machine. I was working for a manufacturer and when one day a program went wrong and we couldn't find out why, someone suggested we go to the compiler support team. Sure enough, the cause was a bug in the compiler.

In those days of about a decade or so ago, compiler writers, like the compilers they wrote, were regarded with awe in the computer profession, being only one step removed *from* those arch high priests, the operating system writers. It would have seemed unbelievable then that anybody could conceive of writing their own compiler. Even more unlikely was that one day someone would write a book on how to do just that — and what is more, a book that is as intelligible, intelligent and (miracle of miracles) as witty as *Peter Brown's Writing Interactive Compilers* and *Interpreters*.

This, for me, is a rare publication because it is a "straight" technical book which I actually *enjoyed* reading. The hobbyist world has, of course, produced many relaxed, colloquial, cartoon-filled, jokey books. But Brown's effort is in the more academic tradition of the mainframe computer world, yet it manages to appeal to the "lay" personal computer enthusiast and the professional programmer.

The tone of the book is captured by its fourteen deadly sins which pepper the text. The first deadly sin, for example, is "to code before you think" and the last is "not to read to the end of the book" (which appears as the last line on the last page). The "sins" are a vivid way of encapsulating important advice without being patronising or hectoring, while the last of the deadly sins shows that Brown has a comedian's wit and sense of timing.

The book works on two levels as a general introduction to computer concepts and as a practical guide to a programmer wishing to actually write a compiler. The practical examples relate to BASIC and the guidelines provided are never dogmatic. Brown is not afraid to recommend one approach

Continued on Page 87

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PURCHASE LEDGER

Compiled and edited by Mike Knight of Mike Rose Micros.

One of the enigmas of most businesses is that our customers expect us to give them unlimited credit for what seems like unlimited periods of time but our suppliers expect us, as customers, to pay our accounts as soon as they are rendered. Of course none of us really like paying bills but unfortunately in both good and bad times we depend to a great extent on the goodwill of our suppliers. In good times we need to be able to increase our material supplies to meet the needs of our expanding markets. In bad times an extra month's credit can sometimes mean the difference between solvency and having the receivers in. In both cases our credit rating will probably have been built up over a number of years of prompt payments. In fact in those industries where prompt payment discounts are the norm, controlling the payments we make to our suppliers may actually increase our profits. In this month's Systems we are therefore going to look at Purchase Ledger.

Objectives of purchase ledger

To control and record details of monies owed by a company for materials, services or goods supplied to it.

In the last Systems I dealt with Sales Ledger; Purchase Ledger can be considered as the other side of the cash flow equation and when the management information it can provide is used together with labour costs, it plays a major part in determining pricing strategy.

Tasks and volumes

TASKS	VLASAK	HB COMPUTERS	PETSOFT CASSETTE	DISC	PETACT	PAXTON	SERENDIPITY	SAIL	BENCHMARK
Update Supplier file	O	O	O	O	O	O	O	O	O
Post transactions — invoices	O	O	O	O	O	O	O	O	O
credits	O	O	O	O	O	O	O	O	O
cash	O	O	O	O	O	O	O	O	O
discount	O	O	O	O	O	O		O	O
adjustments	O	O	O	O	O	O		O	O
Print Remittance advices	O	O	O	O	O	O		O	O
Statements	O						O		O
Supplier list						O		O	O
VAT audit		O							O
Aged balances	O	O	O	O	O	O	O	O	O
Payment list			O	O	O				O
Control list		O	O	O	O		O	O	O
Cheques			O	O	O		O	O	
Ledger cards			O	O	O			O	
Enquiries	O	O	O	O	O	O		O	O
Accounting system — balance fwd	O	O	O	O	O	O			O
open item								O	

Functional requirements

The requirements may be summarised as follows:

1. We must be able to keep details of all our suppliers, adding new ones, removing those we no longer use and making amendments to our existing ones when necessary.
2. We must be able to post all transactions concerning our suppliers to their accounts whether they are invoices, credit notes, cash payments made, discounts taken, or simple adjustments.
3. We should be able to determine priorities in the payment of our accounts and so we would expect to be able to quickly see those accounts which have been outstanding over a certain time, or those which are over or under a predetermined control amount.
4. We may wish to produce cheques or Giro credits automatically.
5. If required, statements and/or remittance advices should be produced.
6. We should be able to analyse our payments and/or balances against the appropriate nominal account headings.
7. We may wish to use the details of our purchase transactions to compute accurately the up-to-date cost of our stock holding.
8. We may like to choose between a forward balance or an open item system.
9. Finally we don't want to lose the advantage of our manual systems in being able to easily look at any individual account.

In the next two sections we will see how nine packages meet these requirements.

Evaluations

VLASAK PURCHASE ACCOUNTING PACKAGE

This is available direct from Vlasak Elec-

VOLUMES

A = alphabetic N = numeric	VLASAK	HB COMPUTERS	PETSOFT CASSETTE	PETSOFT DISC	PETACT	PAXTON	SEREN-DIPITY	SAIL	BENCH-MARK
Account number	3N	4N	3N	1A3N	1A3N	4A2N	8AN	5N	4N
Balance maximum	£1M	£100K	£1M	£1M	£1M	£100K	£100M	£10M	£1M
No. accounts max	200	900	200	1000	2500	600	1500	1000	500
No. transactions	1000	4000	1000	3250	6500	3000	3000	2000	2000
Name/address size	160	85	115	115	115	78		100	76
COSTS									
Package cost (£)	315	350	95	115	350		275	625	250
Hardware cost Min (£)	3350	2400	1450	2250	2345		3000	3500	3600
Total cost (£)	3665	2750	1545	2365	2695	4750	3275	4125	3850

tronics Limited, Marlow, Bucks (06284 74789) or from their dealers throughout England and Scotland. The package is designed to be fully integrated with their Sales and Nominal Ledgers but is available as stand alone at a cost of £315. It was first released in November and has ten users at present. The package is written in BASIC and is supplied with systems and operating manuals. Requests for customisation are always considered and quotations are made according to the amount of work involved. At Vlasak, whilst they believe their package covers all normal requirements, they don't pretend to be infallible and if a customer came up with a requirement which they feel would enhance their product they are quite liable to incorporate it free of charge.

The minimum hardware to run their system is a 48K Apple II, two disc drives and a 132 column printer, which altogether costs £3,350. Included in the cost of the software is free training which can be on site or at Marlow. They expect to sell hardware and software together and offer two types of maintenance contract — one costing 5% of the purchase price per annum which provides a repair service either in house or on site, and the other costing 10% per annum which guarantees a replacement service within 24 hours.

SERENDIPITY SYSTEMS INC ACCOUNTS PAYABLE

This American produced package has been introduced to this country by Great Northern Computer Services Limited, Leeds. (0532 450667) They have completely Anglicised the package together with another eight Serendipity packages and have negotiated an exclusive distributorship for these products throughout the United Kingdom and Ireland. Great Northern's objective is to establish about thirty dealers countrywide and to date they have already covered all of England and Scotland above a line from the Severn to the Wash. There are twelve users in the UK and over two thousand in the United States.

The package costs £275 and can be supplied in CBASIC, Cromemco Extended BASIC and North Star BASIC. The minimum hardware requirement is 48K, dual floppies, VDU and 80 column printer — costing between £3,000 and £6,000. Great Northern supply their dealers with source code and user manuals and provide a full time enquiry service as back up. Installation, training and maintenance services depend on the policy of each individual dealer.

PAXTON COMPUTERS PURCHASE LEDGER

This is available direct from Paxton Computers Limited, St. Neots, Huntingdon, Cambs, (0480 213785) or from their dealers throughout Britain. The package can be purchased for £750 but is normally sold together with Sales Ledger; the minimum hardware is: 48K North Star Horizon, 2 floppy discs, VDU and printer at an inclusive cost of £4,750. The package is written in North Star BASIC with some assembler modules.

Although there are ten programs in the suite this would be transparent to the user since control is always returned to the Menu program. In fact control of the programs is never handed over to either the BASIC interpreter or the operating system (usually CP/M); this is to ensure that mis-operation will not corrupt data.

Paxton's major selling claim is the resilience of their software: "So far no system of ours has crashed through keyboard action, and they retain data integrity even through disc faults". Their claim looks valid since incomplete processing is detected automatically by the software. The package has been available since July 1979 and there are eighteen users.

Their operating manual is designed primarily for the inexperienced user and whilst I believe they have succeeded in this objective, even experienced users have been tempted to disobey their exhortation that, in the event of breakdown, one doesn't kick the computer or punch the VDU. Included in the software cost is a half day's operating training on installation and another half day on the system, usually about two weeks after installation.

SAIL PURCHASES LEDGER

This is available direct from Software Aids International Limited, London N.16 (01-359 2818) or from any of their franchises in Manchester, Cambridge, Harlow or Horsham. The package is written in Microfocus CIS COBOL and will run on any machine using the CP/M operating system. The cost is £625 and the minimum hardware configuration is 32K, dual disc drives and a VDU, (a Printer is optional) — costing approximately £3,500.

Personalisation is included in the cost of the package, but customisation would be charged at normal market rates. Also included are up to five man days of installation support on site and as much training on the systems as is required. Maintenance is provided for one year free of charge. Users are supplied with operating instructions and a user system manual and, since it's a conversion from an existing main frame system, the documentation is pretty comprehensive.

HBC PURCHASE LEDGER

This is available direct from HB Computers Limited, Kettering, Northants, (0536 83922), or from their expanding number of distributors throughout the country. The package costs £350, was introduced in July 1979, and there are twelve users to date. The cost of the package includes half a day installation if the hardware is purchased at the same time and the minimum hardware required is a CBM 3032 computer (32K PET), Commbine 5¼" dual drive disc system and any PET compatible printer, all costing from £2,400.

The system has been designed with ease of use as the priority and as such, customisation has taken a back seat. Formal training is not provided but the manual is considered to be comprehensive and a telephone backup service is provided. Any software bugs found would be fixed immediately free of charge since HB are aware that their marketing efforts depend on bug free software. HB also supply a Sales Ledger package at the same price but if Purchase and Sales Ledger are purchased together then there is a discounted price of £500 for both.

PETSOFT PURCHASE LEDGERS

Two purchase ledger packages are available from Petsoft, Newbury (0635 201131) one uses cassette and the other, Commodore discs. The costs of the packages are £95 the cassette version and £115 the disc. Both packages have over a hundred users and can also be purchased from any of Petsoft's 250 dealers throughout the country. The user is provided with an operating manual but systems information is limited. The minimum configuration is 32K Pet; printer and either cassette or Commodore dual disc drives and costs £1,450 for the cassette system or £2,250 for the disc system. Bugs are corrected free of charge but Petsoft offer no customisation service.

PETACT PURCHASE LEDGER

This is available direct from Petact Business Systems, Birmingham (021 454 5348) or like their subsidiary Petsoft, from any of their 250 dealers throughout the country. The package costs £350 and it's a conversion from a well established mainframe system which has been in use for over 15 years. The cost of the package includes a one day training course at Birmingham and is designed particularly for the first time user.

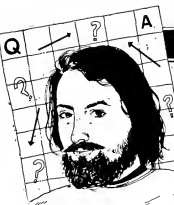
The minimum configuration is 32K Pet, 80 column printer and dual Compu-Think drives. The facilities provided are very similar to the Petsoft systems but instead of five individual programs for the functions there are nine, all of which are driven via a menu selection program. Once again bugs are corrected free of charge but no customisation service is provided.

BENCHMARK 'SNIP'

SNIP is a fully integrated Sales, Nominal, Inventory, and Purchases system which costs £950. Each package, however, is available stand alone from the writers of the software: Benchmark Computer Systems Limited, St. Austell, Cornwall (0726 61000) — purchase ledger costs £250. The system is supplied with all media — including security discs, systems specification and operating instructions. The cost of the package includes an installation service and personalisation.

The minimum hardware required is 32K North Star Horizon, 2 disc drives, VDU and printer, costing £3,600 (including delivery and installation). Bugs are corrected free of charge during a 90-day warranty period but outside this users are notified and are offered the amended program on a diskette — at the price of the diskette. I really must comment on the excellent standard of the systems documentation; it contains not only a good overview but also full file details and sample output. The documentation has obviously been produced using their word processing system which I will be reviewing when I cover that topic in two months' time.

See Page 100 "Bludners"



COMPUTER ANSWERS

Each month Sheridan Williams and his panel of consultants answer readers questions. Topics may be hardware — from kits to mainframes, or software — from differential equations and statistics to file handling or sorting; the choice is yours. Send your questions direct to Sheridan Williams at 35 St Julians Road, St. Albans Herts.

Tied up with strings

There is one thing that puzzles me about microcomputers regarding their string handling. Could you please explain why it is not possible to refer to the nth character in A$ as A$(n,n)? I am considering buying a PET but I can only see mention of LEFT$, MID$ and RIGHT$. Does this mean that it is not possible to use the A$(n,n) format?
H. Frost, Crawley, Sussex

It's not the computer that provides the differences found in string handling, it's the compiler/interpreter; so the way in which strings are handled is independent of whether the computer is a micro or a mainframe. You have encountered one of the many areas of BASIC which are undefined. String handling in one version of BASIC is quite likely to be different to string handling on another machine, even on the *same* machine you can get different versions of BASIC, each with its own rules. You have, in fact, met one of the less frequent types of BASIC and it is comparatively rare to find a micro that does not use the LEFT MID RIGHT system. I won't give any examples here because virtually any book on BASIC will use the LEFT MID RIGHT system, I can only tell you to try it as it is as good if not better than your system.
SW

No go

I am considering the purchase of a personal computer and, this being a new venture, I require some advice. My price range is £1000-£1250 and this puts the PET, Apple etc. in my class. One of my prime uses will be the playing of games such as Chess, and particularly GO (not Gomoko or Go Bang). Are you aware of any games for GO on personal computers? A letter to Compusettes elicited no response whatsoever.
I. Jones, Gwynedd, Wales

I am afraid that I know of no programs that have been written for GO. You may care to ask the British GO Association, 16 Wantage Rd., Reading, Berks to see if they have any more information. Both the PET and the Apple (or ITT 2020) graphics should be able to display the board and pieces etc, but personally I prefer the extra facilities that the Apple provides.

Writing your own program is one answer — preferably with large chunks written in machine-code to speed up the program. It may be tricky writing the part of the program that looks for 'eyes' within the opponent's territory, but by no means impossible. If any of our readers have any more information to add then I'll gladly pass it on. By the way, writing in machine code is very much easier on the Apple than on the PET. Also, if you are considering expanding to floppy discs at some future date then I would have to recommend the Apple's discs in preference to PET's *own* discs.
Mike Dennis

School pleas

The maths department at my school are indecisive as to whether to buy a PET or an Apple or even whether to buy a computer at all. Would pupils soon learn to write useful programs? The school has about 1,000 pupils. How can we raise the money?
T. Lord, Clitheroe, Lancs

In trying to answer your question I will get onto my hobby horse yet again and say that if industry expects and requires programmers, computer engineers and all the other job categories then it had better start to do something about training *now*. Approach some local industry and say "I would like a contribution towards a microcomputer please". Remember that it is in their interest to help because you are training their future employees; it only needs a couple of far-sighted firms to contribute and you will soon have a computer.

I think it is appalling that industry is unwilling to help; to get an idea of the attitude of many companies that employ computer personnel, look for vacancies for TRAINEE programmers — they don't exist; how can we hope to fill the dearth of computer professionals if no-one is prepared to help.

Now I've got that off my chest I will try and answer your other questions. Don't be indecisive — buy a computer. A school is supposed to educate and a computer is an educative tool. It can be used both to teach computing and also to teach other subjects. There is a growing awareness in CAL (Computer Assisted Learning) and already there are packages available, provided that you have a suitable machine. I am not sure why you are reduced to the choice between Apple and PET. . . There are many other micros on the market in that price range. I have my views on the APPLE and the PET but would not like to recommend one in preference to the other without asking several more pertinent questions; go and look at other machines too.

As to the question of whether the students would soon learn to write useful programs, that's up to you. With your guidance and the correct motivation the answer is certainly yes; but leave them alone and all you will probably get out of them is games. Games stimulate learning but by giving them useful objectives you can get amazing things done. Those students that show an aptitude will learn at a frightening rate and unless you have someone on the staff with a fair amount of knowledge they will overtake you at an exponential rate; their brains are still at their peak.

This brings me to another of my worries. Is there anyone available to answer their questions? They'll learn far more slowly by trial and error. We clearly need more trained computer teachers, but with their pay so far behind that of industry, the reason for the shortage is obvious.
SW

Policy making

I work in an insurance brokers. In my spare time I have developed a BASIC program which helps produce insurance quotations. It substantially reduces the time taken to prepare a quote. I am sure it could be of use to many people working in insurance broker offices. I would like some advice on marketing/distributing my program, I am particularly worried about people taking unauthorised copies without paying for them.
A. James, London N4

I can see a number of paths which you could follow. The simplest would be to sell your program to one of the specialist micro software shops; they are geared up to advertising specialist packages like yours. Speaking from personal experience, you may have trouble obtaining what you consider to be a 'fair' price for your rather specialised program. However, if your package is well presented, (documented/programmed) then you may manage to interest one of the larger software shops who will act as distributor, and pay you a royalty for each program sold. I may add that they will only handle really high quality software in this way.

Secondly, have you thought of handling the sales inside the trade?

Perhaps your company would be willing to buy a number of machines and install your software on them. Alternatively, you could approach an insurance company and see if they are willing to buy your program outright and market it to brokers who are willing to buy their own machines (if it really is cost effective, people will put their money out).

On your point of stopping possible thefts (unauthorised copying) I suggest you investigate the possibility of placing your program (or part of it) into a PROM. This would not make copying impossible, but, for most users, it would be easier to buy the program than steal it. You failed to mention the machine on which you have developed your program. I can therefore only give some general points on PROM encoding. PROM programmers can be bought for most micros, and the actual interfacing to a Bus/Port is straightforward. Typical cost of a programmer is £38.50. You would write into the PROM (in machine code), one or two of your BASIC subroutines, and replace their calls with calls to the PROM code. An alternative method I have seen working involved storing the program's data in a coded form on cassette (or on another PROM), and using a PROM subroutine to access and decode it. This works best where the data is compilated (time consuming to prepare) and does not need to be updated by the user; presumably your application would require that data be easily altered. As I have already said, these methods are not totally secure. Best would be to encapsulate the whole program in ROMs soldered into the machine, ensuring that there is no way in which users could examine the machine's store without physically removing the chips.
Jon R. Malone

Taping it

As a newcomer to microcomputing I would like you to answer some questions regarding cassette mechanisms. I understand that there are audio drives and digital drives and that's about my limit. What are the differences in speed, reliability, method of operation and cost? Can cassettes written on one type of drive be read by others of the same type? What I am leading up to is to ask how easy it is to exchange program and data between different systems?
P. Carlson, Battersea

As you say, there are two basic recording formats (sometimes refered to as digital and audio); there are also two basic kinds of cassette mechanisms. The difference between them is that digital recording techniques originated on mini computers (PDPs/Data Generals etc) whereas the audio system came along as the cheaper alternative and was based around standard household cassette recorders.

There are a number of physical differences between the two mechanisms. Digital drives are normally based around expensive, servo controlled, linear DC motors. These can accelerate the tape quickly and position it accurately at high speed. By comparison, audio drives use standard motors which cannot be so carefully controlled; nor will they operate at such high speeds. The speed of the drive is important if high packing density and fast data transfer rates are to be achieved.

Digital drives tend to use reel-to-reel tape mechanisms, where the hubs are used to move the tape. Audio drives use pinch rollers to move the tapes — these can stretch (and chewt) tapes.

Table 1 summarises the specification differences between typical digital/audio drives.
By reliability I presume you are refering to the frequency of information loss rather than to mechanical reliability. With most cassette systems it is possible (with varying degrees of effort) to record your own check data on the cassettes and thus the sky is the limit. You could, for example, record each character a number of times and include checksums and parity bits. These allow software to detect and then correct errors in the data. A particularly simple method (which wastes a lot of space) is to record each data block 3 times on the tape. If any discrepancies occur when reading back the data, the majority vote (2 out of 3) wins. Buying high quality cassettes (try to get 100% certified computer grade tapes if possible) will help reduce data loss.

The method of operation of the cassettes is normally very similar to programming a teletype! After a transfer has been initiated the hardware will set a flag when it is ready to receive/transmit a character; the software writes/reads the next character to/from a suitable location. Obviously there are a number of time limitations imposed by the hardware, e.g. you must supply the next character within 10 milliseconds of the hardware requesting it. To save programming effort and to remove a source of error, many tape drives come with software which provides a "block" interface. You simply tell the software where a block is; and whether it is to be read/written and leave the rest up to it. Blocks are normally 80-150 characters long.

This leads up to your final point — ease of exchange of tapes between machines. Transfer between digital and audio systems is not possible. There is little trouble transfering information between machines of the same make. Similarly exchange between hardware which uses the "Kansas City Format" can also be straight forward. Unfortunately a number of micros use their own internal code when writing information to tape. (It has the advantage that they can replace long commands like "PRINT" and "GOSUB" with single characters). This makes the operations of saving and loading programs much faster.
Jon R. Malone

Table 1 A comparison of Digital/Audio cassettes

	High Quality Drive	Audio Drive
Tape length	150 feet	280 feet
Tape type	High quality, Computer grade, 100% Certified	C30—(say)
Tape speeds:		
Read/write	9 inches/sec	1.9 inches/sec
Search	20 inches/sec	No corresponding
Rewind	100 inches/sec	50 inches/sec
Time on one tape	3.5mins	30mins
Rewind time	20 secs	60 secs
Tape capacity	92K bytes	120K bytes
Typical Baud Rate	4000 Baud	650 Baud
Density	300 bits/sec	400 bits/sec
Approximate cost	£1000	£50

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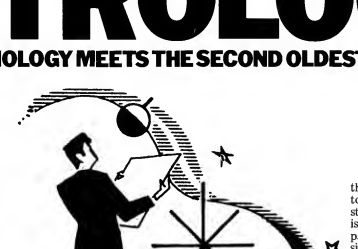
MICRO ASTROLOGY

MODERN TECHNOLOGY MEETS THE SECOND OLDEST PROFESSION



Roger Elliot runs a computerised horoscope service from his Somerset manor house. Here he explains how the planets and computers go hand in hand.

For most PCW readers astrology is a matter of Lucky Stars columns in newspapers and magazines: brief little forecasts that never seem to come true. Real astrology is much more complex. Instead of dividing the sky simplistically into twelve Zodiac signs, one for each month of birth, it takes into account the whole solar system at the exact moment of birth.

From this map of the heavens, it's possible for the astrologer to make a surprisingly detailed character assessment of the person involved: his temperament, inner emotional disposition, talents and hang-ups and even the state of his psyche at any moment in life.

To do this correctly, the astrologer must be both a mathematician and artist. Mathematics are required to calculate the exact positions of the Sun, Moon and planets at the time of birth; and artistry is needed to interpret these hieroglyphs and numbers into a sympathetic language which the client can understand.

Since astrologers, like most people, are more literate than numerate, the traditional way of calculating a horoscope has been made, over the centuries, as painless as possible. All they need do is look up tables of planetary motion, called ephemerides, and intrapolate between one day's position and the next. Then they must find the angular separation between any pair of planets, and, again referring to tables, discover which degree of the Zodiac was rising above the eastern horizon.

The whole process takes half an hour, at most. Then they can become artists again.

Astrologers, as you can imagine, like to believe that their craft requires a great deal of intuition. And so, at the most exalted level, it does. But at an everyday level it is surprisingly logical. Astrological interpretation is really a series of equations: on the left side, a planetary pattern such as 'Mars in Capricorn square Venus in Libra', on the right side a description like 'His dynamism at work contrasts oddly with a sweet but lazy disposition in bed.'

It follows that not only the mathematics of astrology, but some of its artistry too, are amenable to computerisation.

Early efforts

All astrological textbooks contain basic descriptive paragraphs for the main planetary patterns. About 20 years ago, two separate enterprises made the move to computerisation. Astroflash, in Paris, provided a character study based on planets in Zodiac signs and houses: a total memory of not much more than 240 paragraphs, with each client receiving the 20 appropriate to his horoscope. In New York, Time-Pattern Inc devised a more searching analysis, introducing planetary aspects (ie, angles between planets) and trying to marry the various paragraphs together to make a more natural narrative.

I was the first astrologer in this country to put my name to computerised character studies and forecasts. That is, I wrote the necessary paragraphs while a professional programmer stitched them together on an IBM 370. I knew nothing about programming; he knew nothing about astrology; and the end-result lacked any subtlety.

There are three areas of complaint that can justifiably be made against these early efforts:

1. Mathematical accuracy

In my own case, we simply fed an abbreviated 20th-century ephemeris into memory: a highly inefficient use of man and machine.

2. Integrity of text

When a text is composed of disparate paragraphs, without any reference to each other, the most shocking contradictions can occur. A client, for example, can have two conflicting astrological factors: Sun in Gemini, let us say, and Moon in Capricorn. The human astrologer, writing his own report, can marry these factors into a balanced account, explaining how these factors can sometimes help and sometimes hinder each other. But a crude computerised report will blindly announce 'As a Geminian you are lively, restless and fickle' and, in the next sentence, say 'With Moon in Capricorn you are stoical, cautious and conservative.'

3.Personal references

An individual astrologer will relate his report to the personal circumstances of his client. But in these early computerisations the only individual circumstance taken into account was sexual gender; reports for male clients were structured slightly differently from those intended for women.

Starlife project

By the start of 1978 I was aware of the first rumblings of the microprocessor revolution. The downturn of costs, together with the upturn of my own interest in computers, meant that, for a substantial but feasible capital outlay, I could buy and program my own equipment and run a horoscope service from my own home.

The time from conception of this idea to its birth as Starlife was, appropriately, nine months. In nine short months I sorted out my RAMs from my ROMs, learnt BASIC, bought computers, printers and ancillary machines such as guillotines and bursters, wrote two lengthy programs of about 34K each, and, not least, wrote the equivalent of three full-length novels as my basis for my astrological text. It proved to be an exhilarating, exhausting venture, after which I deserved a long vacation. But no sooner had I concluded my work as programmer and author than I had to transform myself instantly into data entry clerk, operator, binder and mail-boy, since I'd had no time to train anyone else to run the system!

For the response, via TV Times, was phenomenal. In the first week there were 2000 applications for birthday horoscopes, and to process these orders I had one Cromemco computer, one Tally printer and one Newbury VDU. True, a second computer arrived in a couple of months; and a second and third printer soon afterwards; but by April I had a backlog of 4000 angry, frustrated clients.

Business considerations

Everything is running smoothly now. But since many PCW readers may be thinking of tackling a similar enterpreneurial venture at some time, in some field if not astrology itself, it's worth analysing my experiences with some care.

If you are thinking of setting up any computerised cottage industry, bear these points in mind.

Equipment

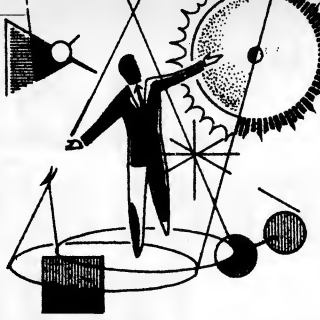
There's a minimum investment below which you cannot stray. As the actress said, don't do a man-sized job with a boy's set of tools. Not only are cheap microcomputers too slow and small and unreliable for the task, but they prevent adequate future expansion. The equipment I chose — wisely, looking back — was a Cromemco System Three computer, with 64K core memory and 1MB of disc memory; and Tally 1612 printers, picked for their reasonable throughput (about 120 cps) allied with their wide range of expanded matrix typefaces. The 7 x 7 half-matrix typeface lacks descenders true enough; but the end-result on the page is stylish and professional. In common with many Tally users, I have had a number of stoppages caused, apparently, by some kind of tarnishing within the RAMs through overuse; but Tally have done many modifications and seem to have solved the problem now. With the Cromemco cards I've had virtually no trouble at all; but the discs have, like medieval heretics, frequently passed into a state of error. Sometimes this has been bad luck: components failing quicker than they should. More often the fault has been my own dusty, french-windowed office, full of Somerset motes. If I were buying afresh, I would pick the new Cromemco Hard-Disc systems, for their promised reliability and speed.

The Starlife programs

These split into two groups: those dealing with data input and the main Birthday Horoscope program which creates the actual reports. Let's take them in order:

1.Data input

Each application must be processed in two ways: temporarily into an ORDERS file (holding 100 at a time) and



permanently into my alphabetical CLIENTS files.

The first data to be entered are surname, date, month and year of birth. Armed with this information, the appropriate CLIENT file is searched to see whether this is a new or existing customer. Additional data is then entered: birthplace and birthtime (with summer time automatically deducted and the computer picking a random birth-time if the actual time is unknown); first name; sex; marital status; address; type of report needed; and payment. There are various fail-safe routines for trapping and changing input errors; and the data is then stored in ORDERS and the correct CLIENT files.

2.Ancillary files

There are various files supporting this program. Latitudes and longitudes of every place-name in the British Isles are filed in the 26 LATLONG files. Time-zones are extremely complicated, especially in the US where adjacent counties in the same state might — or might not — adopt summer time in a particular year. Various TIME files calculate these adjustments for most countries in the world. Most important of all are the CLIENT files, 575 of them grouped alphabetically on 36 discs which can accept a maximum 50,000 customers. The first four letters of a client's surname establish which file is the correct one. (Problem : the MACs, JOHNsons and SMITHs now take quite a few seconds to search.) With a hard-disc system there would be none of this swapping and changing of discs, of course; on the other hand, this disc-handling does add variety to the operator's routine and prevents, I think, errors through boredom. As it is, we have an average error-rate of 2%.

There is no back-up for these 36 discs. *(What! Ed).* My Verbatim 8" floppies have never let me down, after a year's operation.

Birthday horoscope

This is the most complex astrological word-processing program ever written. It generates a 10-page report covering the next 12 months of the client's life. The first half deals with the broad trends: your overall attitude to life in the coming year, how the world will treat you, and how you will fare at home and work, in love and friendship, in health and finances. The second half picks out the key dates in the coming year, giving some 90 precise predictions.

The text is composed of about 136 different paragraphs, chosen from a total data-base of about 2,500 different paragraphs. The chance of receiving the same report as another client is virtually nil; you would need to be born within five minutes of each other, and still be living in the same town, and to apply for your horoscopes on the same day, for this to happen.

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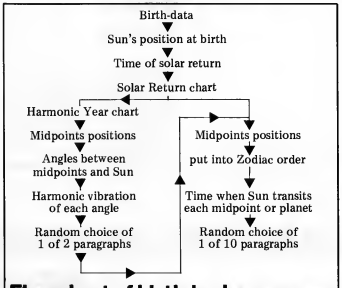
more of a personal touch, there are numerous references inserted into the text: your first name, your age, your place of birth, your marital status and so forth. Certainly this style — to say nothing of the content — seems to be successful, for out of 10,000 clients in the first year of operation only seven have asked for their money back.

The flow-chart of this program shows how detailed is the mathematical analysis of the horoscope. First the program calculates the position — to the exact second of arc — of the Sun's geocentric longtitude at your moment of birth. This is done using formulae, not an ephemeris, taking into account all the gravitational perturbations within the solar system. Then it works out the moment of solar return, when the Sun returns to this same position in the sky in 1980, and calculates all the remaining planetary positions for the same time. This is the solar return chart.

This chart is believed to resonate at different frequencies for different people, and so it's turned into your Harmonic Year chart by multiplying all factors by your age. Then the computer works out the positions of all planetary midpoints — that is, halfway points of the angles of separation — and the angles between these midpoints and the Sun.

Are you still with me? The next step is discovering the harmonic content of each of these angles: the frequency at which it vibrates, so to speak. Once this is known, the computer selects at random which of two similar paragraphs will be printed.

To give an example: let's say that in your 1980 harmonic year chart Venus is at 140 degrees and Pluto at 190 degrees. So their midpoint is 165 degrees. If the Sun is at 120 degrees, the angular separation is 45 degrees, which means that it vibrates on the 8th harmonic (360 degrees, of the sky divided by 45). In disc memory there's a file called HARMONIC, 35 corresponding to the Venus-Pluto midpoint, which contains 24 records — two for each of the twelve possible harmonics at which this angle can vibrate! So the program picks one of the two relevant records, and prints it.



Flow chart of birthday horoscopes

That takes care of the first half of the report. For the remainder, the program returns to the original solar return chart and calculates all its 78 midpoints, sorting them in anti-clockwise order from the Sun's position. It then works out when, in the course of the next 12 months, the Sun moving at variable speed through the geocentric Zodiac forms a transit with each midpoint and planet in turn. For each transit there's a set of 10 similar paragraphs, one of which is randomly chosen for inclusion in the report.

This program fulfils two important objectives: first, it produces a standard-sized report for each client, ensuring value for money (for the snag with other forms of astrological prediction is that they give a bumper crop of forecasts one year and perhaps a dearth the next); and secondly, it is perpetual, as valid in 100 years' time as it is today. If any religious PCW readers wish to know the prospects in 1980 for the Living Christ, Starlife can tell you — provided, of course, that you supply the correct birth-data.

Future prospects

Although I'm proud of Birthday Horoscope, I recognise its short-comings. Despite its intricacy, it remains a 'painting-by-pictures' report. The program, when printing a paragraph, cannot relate it to any other paragraph.

So the next step must be to program the computer to weigh and consider each astrological factor in the light of other factors. In a character analysis program that I'm writing now, the computer will scan the whole chart and give it a label or nickname: a summary of its salient characteristics. It might be 'Lucky Spiv' or 'Melancholy Scientist' or 'Shy Do-gooder'. It will then stitch together the appropriate sentences in a way that suits the person involved.

The aim of all astrological program design should be to reduce the data-base whilst increasing the flexibility. An example: you need 12 paragraphs to cover the Sun in each of the 12 signs, and another 12 for the Moon in each of the signs. But 144 are needed to cover the Sun-Moon combinations and 1728 to cover the Sun-Moon-Ascendant permutations.

If, on the other hand, you have a smaller number of sentences, or parts of sentences, and marry them together with ingenuity, you can produce a much more individual report. Shakespeare, after all, had a data-base of .30,000 words; he just put them together in such idiosyncratic ways.

Starlife software

Software, suitable for 8K and and 16K PETs, Apples or TRS-80s, is available on cassette or 5" disc. With this package you can generate birth-charts, solar and lunar returns, transits, progressions and synastric charts, together with aspects, midpoints and harmonics. Prices range from £15 to £25.

If you are keen to develop your own programs in astrology, you should get hold of copies of Matrix magazine from 1041 North Main Street, Ann Arbor, Michigan 48104, USA. It's a quarterly, and six have been issued so far. They are packed with invaluable advice, formulae, short cuts and programs. They cost $10.00 each, airmail. The best approach, now that there are no currency restrictions, is to mail $20 or $30 in notes to Michael Erlewine at that address, and he lets you know when you owe more.

Birthday horoscopes (£4.80 — send date, place and time of birth) — and software catalogues (£1.00) are available from Starlife, Cossington, BRIDGWATER, Somerset.

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Less than 2 years ago PCW became the first magazine in Europe to deal exclusively with the home and business use of Personal Computers. It has been an unqualified success. The current subscription list stands at well over 3,000, with a staggering 70% renewal rate! PCW reader loyalty is already a by-word in the publishing business. We aim to keep it that way. So if you are having difficulty in obtaining PCW at your newsagent, why not take out a subscription and have the magazine mailed to you direct?

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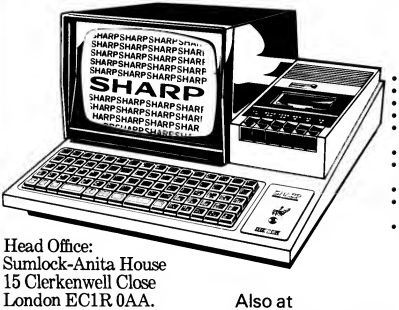

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SUMLOCK BONDAIN

PCW SURVEY - THE PRIZEWINNERS

At least 1,957 people will hardly need reminding that back in our November 1979 issue, not only did we include the first Reader Survey of the new "regime" — we also promised to give away to the sender of the first questionnaire out of the bag, a really exciting and valuable "star prize" — a Sharp MZ-80K microcomputer, very kindly donated to us by Sharp UK.

As promised, on 10th December last, Sharp's Paul Streeter drew the winning entry — plus another 25 runners-up, who will all receive a free year's subscription to PCW.

Why 1,957 people. . .? Well, that's the number of questionnaires returned, as of December 10th. As magazine surveys go, such a return ranks very high indeed, and entirely apart from the fact that the information gained is already starting to prove most valuable, we've had quite a few chuckles over some of the "comments" concerning the Age/Name blunder on Question 1!

To quickly put 1,956 readers out of their misery, the winner is: *Terry Rigby*, a TV Transmission Engineer from East Sheen in London. He received his prize from Paul Streeter at a ceremony that took place at Personal Computers Limited, in London's Bishopsgate on December 21st. PCL's Mike Sterland generously upped the 24K Sharp to full size and he also gave Terry a year's free guarantee on the machine. Total value £850.

Paul Streeter congratulates Terry Rigby on winning his Sharp MZ-80K — and a pat on the back from Mike Sterland.

The 25 subscription winners are: Clive Crocker of Pinner in Middlesex; R.A. Du Boisson of Stretford in Lancashire; John Hyde of Frimley in Surrey; "no name" of East Horsley in Surrey; Andrew Thompson of Cottingham, N. Humberside; M. E. Morrice of Rugby in Warwickshire; D. I. Smith of Urmston in Lancashire; M. J. Parker of Letchworth in Hertfordshire; R. Wilson of Cirencester in Gloucestershire; John Kirk of Rothwell in Northamptonshire; Mr P. A. Varnes of Wigan in Lancashire; Bill Oliver of South Harrow in Middlesex; "no name" of Andover in Hampshire; David Akerman of Dagenham in Essex; N. W. Edgerton of Hove in Sussex; Mr G. R. Prett of Caversham in Berkshire; W. Flavell of Crawley in Sussex; Nigel Cook of Wickford in Essex; Tony Falla of Nottingham; B. S. T. Marriott of Slough in Berkshire; Jerome Perkins of London SE8; John Lee of Southwell in Nottinghamshire; G. F. Clarke of Cheylesmore in Warwickshire; S. J. Evans of London SE19; "no name" of Waterlooville in Hampshire.

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CHECKOUT

VECTOR GRAPHIC FLASHWRITER II

There are really only two ways to convey text (or graphics symbols) to a VDU screen from a computer. Either characters are transmitted serially from the computer to a terminal unit, which then orders them on the screen according to their position in the sequence, paying due attention to any embedded formatting instructions; or, the computer directly places each character in a memory location which corresponds, via a one-to-one hardware mapping to a screen location. This second method, known as "memory mapping", is implemented by the "Flashwriter II" video board, manufactured by Vector Graphic Inc. Andrew M Stephenson reviews it.

Features

The noteworthy features of the Flashwriter II are:

1. Flicker-free display of 80 characters on each of 24 lines, consecutively addressed from a choice of starting locations.
2. S-100 bus compatible.
3. Non-interlaced pseudo-US frame standard; both composite video and direct-drive outputs available.
4. Re-programmable font of symbols: 128 supplied; 256 possible. Full ASCII set with true descenders supplied, plus graphics in "control" code area.
5. High bit (bit 7) sets inverse video and/or reduced intensity; or it helps select 1-of-256 characters.
6. 4MHz addressing, with "waits".
7. On-board parallel keyboard port.
8. Socket for optional ROM, with optional "Jump-on-power-up".

Availability

At least three stockists of the Flashwriter II regularly advertise in *PCW*. Currently, Almarc say that it should be available either ex-stock of at 6-8 weeks' notice, at around £230. Kit versions are *not* made.

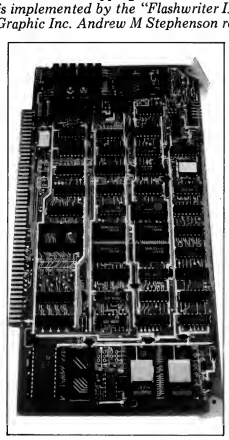
The board was designed to interwork with the Vector Graphic "mindless terminal", which houses both keyboard and direct-drive monitor. As the terminal is not sold on its own, it must be ordered with the board, in which case the appropriate connecting cables will also be supplied. Some sources will happily sell the board alone, others are reluctant, so ask.

Compatibility

Nominally an S-100 unit, the Flashwriter II does not appear to conform to the new IEEE specification. Board buffering has not been fitted, but it is probably safe enough to assume a single, normal TTL load/source per line. All three power rails are needed: +8v (@ 910mA), +16v (@ 54mA), -16v (@ 31mA).

My board is Revision 2, dated 7 February 1979. Revision 1 of the manual was 30 January 1979, so obviously this is a product which has been evolving rapidly. Whether these frequent revisions were merely improvements, or were bug-hunts, I cannot say. My board certainly seems free of faults. The basic design derives from an earlier 64 character by 16 line VDU board and is very straightforward.

An important compatibility consideration is the usefulness of the supportive documentation, and in this respect the Flashwriter II is acceptably well served by a loose-leaf (US 3-hole punched) manual of 19 text sides plus diagrams of the supplied character font, the circuit, and the component layout.



On the whole, the manual (Revision 3, dated 29 March 1979) is clearly and informatively written, though at times it seems uncertain whether it is being read by an expert or a "box operator". Presentation and style are clean, the diagrams uncluttered, the printing good.

My main complaints would be that, although the circuit diagram shows all components and their values, and identifies the important waveforms, enough component numbers are missing to be a nuisance and some S-100 edge connectors are repeated with no indication of the fact, thereby making circuit tracing needlessly difficult. There are also at least three mistakes in it. However, these are slight defects in otherwise helpful documentation.

Construction

The standard is good, with a double-sided glass fibre p.c. board that has plated-through holes and solder masking, and gold plating on the S-100 connector. Video output is through a 6-pin Molex connector, for which a plug kit is supplied. For those with mainframes of the correct dimensions, removal of the board is assisted by a pair of corner levers.

Apart from the odd IC (which may have been in short supply at the time of mass assembly) sockets have only been fitted where they are essential, such as under the two character ROMs, the keyboard port, and the spare ROM.

Several options have to be selected by cutting PCB tracks and linking others. Competent workmen should encounter few difficulties here.

The VDU

To the CPU and the programmer, the VDU board "looks" like a 2K block of 4MHz RAM, of which the lower 1920 addresses match screen locations running across from the top lefthand corner, down the screen in the conventional reading pattern, with consecutive addressing throughout (i.e. second line, first character, is the eighty-first address). Board origin is supplied as D000 but may be set to any 2K boundary from C000 upwards. The top 128 bytes are "spare" and may be used as the programmer prefers.

The display is beautifully steady (but see "Tips", later) and, completely free of update-flicker; that's because CPU access is retricted to the inter-line blanking period. As a result, the CPU may be forced to wait (using the "PRDY" line [pin 72]) for anything up to 46 microseconds. In practice, this delay will only bother the most demanding users. For example, a 2.5MHz Z80 should be able to perform an average of three "LDIR" cycles per screen line period, which means a complete screen re-write would take about 44ms. A 4MHz Z80 could do much better. Delays can occur during both "write" and "read" operations, including those involving the top 128 bytes.

The empty on-board ROM socket may be strapped for 2708 or 2716, with the same choice of base addresses as the VDU. If the "Jump-on-power-up" option is selected, pulsing the "POC" line (pin 99) low will enable the ROM and can also (if strapped) force the "PHANTOM" line (pin 67) low until the ROM is addressed. Sadly, if the user's system does not use the "PHANTOM" line, the Flashwriter II's "Jump-on-power-up" option could be tricky to set up correctly, so this feature would appear to be of doubtful value. Thankfully, only two NAND gates have been sacrificed to it.

The board is also capable of generating "MWRITE" (pin 68) from "PWR" (pin 77) and "SOUT" (pin 45).

Video Output

Both composite video and direct drive monitors are catered for. Line standard is pseudo-US, that is, vertical scan rate is 59.92Hz; there are 262 lines per scan, the scans not being interlaced.

The composite video signal measured at the output of my board is shown in Fig. 1. Voltage levels are not standard but good results were obtained on a Ceedata 1230 GHB monitor having a bandwidth of 10-12MHz. The 4 micro

second line sync pulse in the inter-line blanking period can be repositioned by an on board trimpot, sliding the displayed block of text left/right across the screen.

The direct drive signals available are: an approximately 4 micro second positive "horizontal" pulse from a TTL gate; an approximately 128 micro second negative "vertical" sync pulse from a TTL gate (option; positive pulse); positive "video" from two 7406 gates with a 150 ohm pull-up resistor.

Unfortunately, there is no true standard for direct drive monitors, so various manufacturers' units require all sorts of pulse widths and phases. The Flashwriter II is meant to drive a Ball Brothers TV120, but mine is being used successfully on a Digivision MWD12 having a nominally incompatible set of sync pulse requirements. In fact, only slight alteration of the VDU board was required (the addition of a 680pF capacitor).

Varying the displayed characters

As supplied, the Flashwriter II will display a full set of ASCII characters, white-on-black, including "DEL" (7F) which shows as a fine-grain chequerboard. "Control" codes show as graphics, as in Fig. 2: cells 'a'-'e' reflect the states of bits 0-4 ("1"="on"); and if bit 7 is set, 'a'-'e' are inverted and cell 'f' is set "on".

In general, if bit 7 is set, inverse video is specified for that screen location. Optionally, reduced intensity may be selected (the user fits a resistor whose value defines the intensity), simultaneously or as an alternative.

The two character PROMs define the entire location field, 8 dots wide by 10 lines high; one handles the top 8 lines, the other the lower 2 lines (see Fig. 2). Most of the supplied characters lie within a field of 5 dots by 7 lines, plus 2 lines for descenders. If the user wishes, the set of 128 symbols can be expanded to 256, by substituting a 2716 and at the expense of inverse video and reduced intensity (unless, of course, these features are to be used simultaneously with the "upper" 128 symbols in the new set).

Keyboard

The latched keyboard port can respond to either positive or negative going strobe edges. Port addresses are selectable: 2n (status) and 2n+1 (data), where n=0?. If desired, an interrupt on the "PINT" (pin 73) may be generated when data is available; also, the status byte shows READY on bit 6 and READY on bit 0. Bit 5 of the status byte is "0" during the 22-line vertical blanking period.

Tips

Here are a few tips drawn from personal experience:

Without a doubt, it is a very poor sort of direct drive monitor which will not give a display superior to that obtainable from a comparably priced composite video unit. With a dot rate (the rate at which screen character elements change brightness level) of 14.318MHz, the Flashwriter II needs a monitor of about that bandwidth. Reasonably priced composite video units can usually offer 10MHz or so, guaranteed. Whilst this will permit the resolution of most details, it is less than adequate if the screen must be looked at for very long. By contrast, even an average direct drive monitor has a bandwidth in excess of 20MHz.

Having bought a good VDU board and a matching monitor, too many users then link the two with inferior cable. This is silly: don't just take it for granted that cable, sockets, plugs or joints are up to scratch — check them. Noticeable improvements can be produced with this simple precaution.

If the display wobbles or ripples, check for stray magnetic fields, such as from power supply transformers. Monitors powered by 50Hz mains but displaying at 60Hz field rates are especially sensitive to this problem, although a separation between mainframe (metal cased) and monitor of a couple of feet is usually sufficient.

Finally, the good news: the Flashwriter II seems quite happy with unmodified mainframe supply rails, demanding no special precautions in that area.

Optional 2K systems monitor

(Note: this section was written purely from Vector Graphic literature kindly supplied by Almarc Data Systems Ltd. Therefore, the accuracy of remarks made here are dependent entirely upon the accuracy with which I have interpreted that literature. However, in common with the Flashwriter II manual, it's well written and seems unambiguous.)

Vector Graphic also sell a 2K Extended Systems Monitor for the Z80. Release 4.0 (dated 15 October 1979) is available on new 2708s at around £25 and is aimed specifically at the Flashwriter II in a Vector Graphic system. As such, it embodies several commands which are system specific jumps to strange addresses, for example — and expects a keyboard on ports 0 and 1. No one can damn it for that. However, we shall see that it also embodies enough oddities, and even defects (in my considered opinion), to give any wise potential purchaser reason to pause.

Without these idiosyncracies, it would be a useful addition to the system software, for it has several fine features such as a versatile video driver, two powerful memory test commands, and a useful memory examine/change command. In all, there are some two dozen commands. Unfortunately, the principle of *caveat emptor* cannot be allowed to prevail, for Vector Graphic has filled no fewer than four sides of their Flashwriter II manual with attractive publicity for their Monitor, so an overt warning here seems fair.

Several of the Monitor commands exhibit curiously half-engineered appearance, as if the designer(s) failed to think through the logic of their functions fully. For example, there are separate commands to find one and two bytes, and separate commands for wide and narrow-screen memory dumps; these are but two examples of commands that could easily have been rationalised.

Then, the method of entering hex values is ridiculously clumsy. If, say, four characters are needed, either exactly four must be given, with no chance of error recovery save by retstarting the command, or "SPACE" must be hit to signify leading zeroes; other Monitors are content to accept the last four characters entered, and use "SPACE" to signify completion of the entry, leading zeroes always being assumed, by default.

But the real villain of the piece is the Block Move command. If a block of bytes is moved upward through memory into an area which partially overlaps the original area, the overlapped area will be corrupted; yet this glaring fault is actually claimed by the Monitor manual to be a useful feature.

To its credit, the Monitor does take such sensible precautions as converting lower case letters to upper case, and ignoring meaningless entries. All is by no means losts. However, I could not with a clear conscience recommend this Monitor to anyone, except those desperate for a video driver (a nice piece of programming, as I have said); owning a Vector Graphic system might sway the decision, otherwise, one should wait for future revisions.

Verdict

Let's be quite clear about one thing; whilst I have little love for the Extended Systems Monitor, Release 4.0, I have no hesitation in recommending the Flashwriter II video board. Some users may find that a couple of options clash with their systems, but as a straight video board my unit has given next to no trouble at all. It is not for the casual user, perhaps (the need for a good quality monitor is a complication) but, as an adjunct to my "WordStar"-based wordprocessor for the past six weeks, it has proved entirely satisfactory. Besides, it appears at present to be the only realistically priced 80x24 memory mapped S-100 VDU board on the British market.

Figure 1: measured composite video signal from VDU (inter-line period).

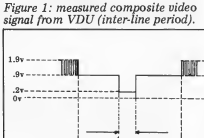
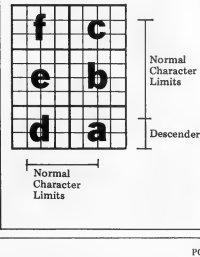


Figure 2: supplied character format; graphics use cells 'a'-'f'; "DEL" fills whole area.



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COMPUTER GAMES

AND THEN THERE WERE TWO

Chess Master, David Levy, continues his series of articles on the principles behind playing computer games with a study of the added difficulties involved in introducing a second player.

Two-person games

Two-Person games, such as chess, backgammon and draughts, are usually more interesting and challenging than one-person games, and it is to these that we shall be devoting most of our studies. The introduction of a second player creates manifold difficulties that do not exist in a one-person game, but fortunately for today's programmers these difficulties have been extensively analyzed in the computing literature and the problems are now rather well understood.

The two-person game tree

Game trees become more complex structures when an opponent appears on the scene. Let us consider a relatively simple game, noughts and crosses (tic-tac-toe to our American cousins), and examine how its tree will look after a move or two of look-ahead. We shall assume that "cross" moves first.

From the initial position there are three essentially different moves:

1) e (the centre)
2) a,c,g and i (the corners)
3) b,d,f and h (middle of the edges)

On the first move, any of group (2) is equivalent to any other, since all four moves are merely reflections or rotations of each other. Similarly, within group (3) all moves are equivalent. This technique of utilizing symmetry to reduce the magnitude of the problem is well worthwhile when programming a game that lends itself to a symmetrical analysis. By reducing the number of moves that need to be examined at any point in the tree you will be cutting execution time dramatically, because the combinatorial effects of tree growth are enormous. The savings in time that can be achieved through using symmetry can be extremely valuable when improving the performance of the program by making its evaluation function more sophisticated (and slower).

If we so decide, our program can terminate its search of the tree after looking at each of its possible moves from the root. This is called a 1-ply search because the program only looks one "ply" deep. (The term "ply" is used to denote a single move by one player.) In order to decide which move to make, out of m_1, m_2 and m_3, the program will then apply its evaluation function to the three positions at the lower end of the tree (these are called the terminal positions). Whichever position had the best score would then be assumed to be the most desirable position for the program, and the program would make the move leading to that position.

How should we set about designing our evaluation function? This is one of the fundamental problems in game playing programming because a good evaluation function will help the program to make good judgements, and hence to play well, even though the depth of look-ahead may be shallow. A poor function, on the other hand, might well result in poor play even with a deep and time consuming search of the game tree. It is therefore very much worthwhile putting some careful thought

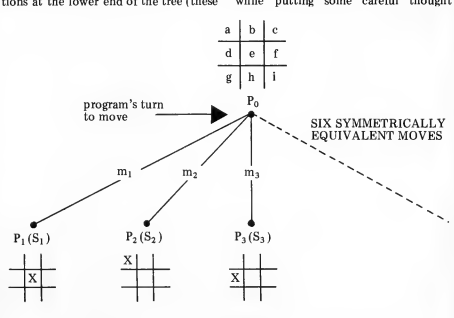


Figure 1

into the design of the evaluation function, and the following example should illustrate the type of thinking that is necessary.

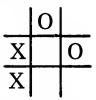
The object of the game is to create a row of three of your own symbols. We shall call this a "3-row". The next most important thing is to prevent your opponent from making a 3-row, which means that he should not have a 2-row after you move (a 2-row has two symbols of one player and one empty space). Next most important is the creation of your own 2-rows; then it is important not to leave your opponent with 1-rows (one of his symbols and two empty spaces); and finally you should try to create your own 1-rows. All of these features could well be incorporated into a noughts and crosses evaluation function.

If we denote the number of cross' 3-rows by c_3, the number of nought's 2-rows by n_2, the number of cross' 2-rows by c_2, the number of nought's 1-rows by n_1, and the number of cross' 1-rows by c_1. . . then one measure of the merit of a position from cross' point of view would be:

$$c_3 \cdot n_2 + c_2 \cdot n_1 + c_1$$

but this measure has one obvious drawback. It does not allow for the fact that the term c_3 is more important than n_2, which is more important than c_2, and so on. This can be done by multiplying each of the terms in the evaluation function by some numerical weighting, in such a way that the weightings (hopefully) reflect the relative importance of each feature. The evaluation function then becomes $(k_3 \times c_3) \cdot (k_2' \times n_2) + (k_2 \times c_2) \cdot (k_1' \times n_1) + (k_1 \times c_1)$ where k_3, k_2', k_2, k_1' and k_1 are the numerical weightings. Since one c_3 is worth more than all the n_2s in the world, i.e. a winning row is more important than any number of 2-rows, we can set k_3 to be some arbitrarily high number, say 128. By studying the game for a few minutes it is possible to see that if one side has a 3-row, the other side may have at most two 2-rows, so to reflect the relative importance of one's own 3-rows and enemy 2-rows it is necessary to ensure that $k_3 > 2 \times k_2'$. We can therefore try $k_2' = 63$. (If one side has a 3-row and his opponent two 2-rows, the opponent will not have any 1-rows to upset this scoring mechanism).

If there are no 3-rows, but one side only has a 2-row, his opponent cannot have more than three 1-rows, as in the following situation.



So $k_2 > 2 \times k_1$ and $k_2 > 2 \times k_1'$ and we can try $k_2 = 31$, $k_1' = 15$ and $k_1 = 7$. Remember that we can modify these values in the light of experience with the program, the values 128, 63, 31, 15 and 7 are merely our first estimates. Having made these estimates we should then ensure that the score for a noughts and crosses position will never cause an overflow, and we do this by setting up positions which will have the largest and smallest possible scores, and counting the number of 3-rows etc. in each. This is a very important part of evaluation function design, and I remember a chess programmer who could not understand why his program crashed whenever it was winning or losing by a great margin — he had forgotten to allow for the possibility of one side being two queens ahead and when that happened his evaluation calculations created an overflow.

If we now return to figure 1 we can see that each of the three possible first moves results in the creation of a different number of 1-rows. Applying the evaluation function.

$$128 \times c_3 - 63 \times n_2 + 31 \times c_2 - 15 \times n_1 + 7 \times c_1$$

to the three positions P_1, P_2 and P_3 we find that in each case $c_3 = n_2 = c_2 = n_1 = 0$, and therefore:

$S_1 = 128 \times 0 - 63 \times 0 + 31 \times 0 - 15 \times 0 + 7 \times 4 = 28$
$S_2 = 128 \times 0 - 63 \times 0 + 31 \times 0 - 15 \times 0 + 7 \times 3 = 21$
$S_3 = 128 \times 0 - 63 \times 0 + 31 \times 0 - 15 \times 0 + 7 \times 2 = 14$

and S_1 is the most desirable of these scores so the program would make the move m_1 to reach position P_1 (i.e. it would play in the centre).

The 2-ply search

The 1-ply search is the simplest form of tree search in a two-person game, but it does not take into account the fact that once the program has made its move there is an opponent waiting to reply. It may be the case that a move which, superficially, looks strong, is seen to be an error when we look a little bit further into what may happen. The 2-ply search will "see" more than the 1-ply search and so moves made on the basis of a 2-ply search will be more accurate (provided that the evaluation function is not a disaster area). How can we take into account this extra dimension of the opponent's move?

Let us look at the same tree, grown one ply deeper, i.e. to a total depth of two ply — one move by the program and one move by its opponent.

If "cross" plays in the centre, "nought" has two essentially different replies, in a corner or on the middle of an edge (represented by positions P_{11} and P_{12} respectively). If "cross" makes his first move in a corner (P_2), "nought" will have five different reply moves (m_{21} m_{22} m_{23} m_{24} and m_{25}) leading to positions P_{21} P_{22} P_{23} P_{24} and P_{25}. After "cross" plays move m_3, "nought" again has five replies. It is easy to see how the tree grows. In last month's example, the 8-puzzle, the

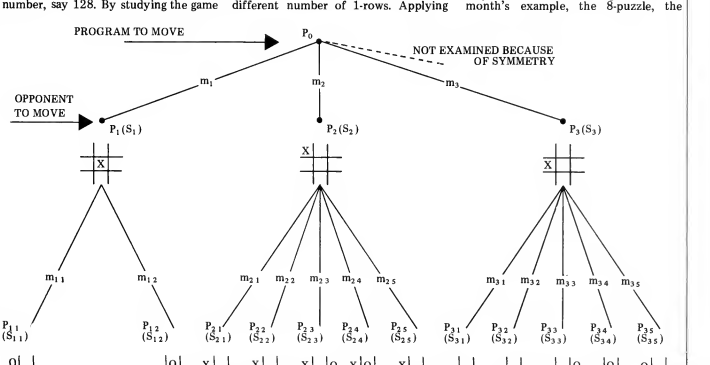


Figure 2

branching factor (number of branches from each position on the tree) was never more than three. Here it is more, even allowing for symmetry.

Let us consider how the program might analyze the situation. It uses its evaluation function to assign scores to the terminal nodes P_{11} and P_{12}. In each case $c_3=n_2=c_2=0$. In position P_{11}, $c_1 = 3$ and $n_1 = 2$. In position P_{12}, $c_1 = 3$ and $n_1 = 1$.

We now have:

$S_{11} = (-15 \times 2) + (7 \times 3) = -9$

$S_{12} = (-15 \times 1) + (7 \times 3) = 6$

This information indicates that if the program is sitting in position P_1, with its opponent to move, its opponent may choose between moves m_{11} (leading to position P_{11} of value -9) and m_{12} (leading to position P_{12} of value 6). The program's opponent wants to minimize the score and so it would choose move m_{11}, for a score of -9, and so the real value of position P_1, represented by S_1, is this *backed-up* score of -9.

If we apply the evaluation function to positions $P_{21} \ldots P_{25}$ we will get:

$S_{21} = (-15 \times 3) + (7 \times 2) = -31$

$S_{22} = (-15 \times 2) + (7 \times 2) = -16$

$S_{23} = (-15 \times 2) + (7 \times 2) = -16$

$S_{24} = (-15 \times 1) + (7 \times 2) = -1$

$S_{25} = (-15 \times 2) + (7 \times 3) = -9$

Wishing to minimize the score when making its move from P_2, the program's opponent would choose move m_{21}, leading to position P_{21} and a score of -31.

Similarly, when applying the evaluation function to positions $P_{31} \ldots P_{35}$, we get:

$S_{31} = -38$

$S_{32} = -8$

$S_{33} = -31$

$S_{34} = -16$

$S_{35} = -23$

so the program's opponent, when making its move from P_3, would choose move m_{31} for a score of -38.

We now have the following situation. If the program makes move m_1, its oppoent, with best play, can achieve a score of -9. If the program plays m_2 then its opponent can achieve a score of -31. If the program plays m_3 then its opponent can score -38.

Just as the program's opponent wishes to minimize the score, so the program wishes to minimize the score. The program must now choose between m_1 (for -9), m_2 (for -31) and m_3 (for -38). Since the maximum of these three values is -9, the program will play move m_1, and the backed-up score at the root of the tree will be -9. This represents the score that will be achieved with best play from both sides.

This procedure of choosing the maximum of the minimums. . . etc. is known, not surprisingly, as the minimax method of tree searching. It is an algorithm that finds the move which will be best, assuming correct play for both sides, provided that the evaluation function is reasonably accurate.

Memory requirements for a minimax search

One of the great advantages of the minimax type of search is that it is not necessary to retain the whole tree in memory. In fact it is necessary to keep only one position at each level of look ahead, together with a certain amount of information about the moves from each of these positions. Let us see how this works for our 2-ply tree.

From the initial position P_0, the program generates the first move for cross, to position P_1. Before proceeding to the other moves that cross can make, the program generates the first reply move by nought, m_{11}, reaches position P_{11} and assigns it the score S_{11} (-9). This is the first terminal node to be evaluated, so the score of -9 represents the best score found so far and this is the score that is assigned to S_1. Since P_1 is the first move at 1-ply to be examined, this score of -9 also represents the best score found so far at the 1-level, and this is the score assigned to S_0.

The program now looks at P_{12}, which we sometimes refer to as the brother of P_{11} (and P_1 is father to both of them). The program determines the score S_{12}, compares this value (6) with the best score found so far at this level (-9) and finds the -9 preferable, so the scores S_1 and S_0 need not be adjusted at this stage. The program next looks for a brother to P_{12}, but finding none it goes back up the tree and looks for a brother to P_1, which leads it to position P_2 and then to P_{21}. On the way down this part of the tree the program assigns to P_2 a score of -9, since this is the best that can be achieved so far. When looking at P_{21} the program finds a score of -31, which is better for the program's opponent than -9 and so S_2 is now set to -31.

Note that as this process continues, the brother nodes that have been examined in the past no longer serve any useful purpose and so they can be discarded. At the present point in our search we no longer need the brother of P_2 that has already been examined (P_1), so P_1 and its successor nodes are not kept in the tree at this time. The tree, at this moment, comprises only P_0, P_2 and P_{21}.

Having evaluated P_{21} we throw it away and look at P_{22}, which has a score of -16. The program's opponent would not prefer this to the -31 already discovered, and so no change is made to S_2. The program discards P_{22} and replaces it with P_{23} for a score of -16, also of no value to the program's opponent, and this is replaced in turn with P_{24} and P_{25} which also produce no change in S_2

Since S_2 (-31) is less attractive for the program than the best score found so far (-9 at S_0), the score at P_2 is not backed-up P_2 itself is discarded to make way for P_3, and the same process continues, with the program looking in turn at the scores of $P_{31} \ldots P_{35}$

Task for the month

The evaluation function for noughts and crosses which we have been using in this example has five features. Try to devise evaluation functions with as few features as possible, for playing noughts and crosses with (a) a 2-ply search; and (b) a 3-ply search, and test your functions by writing a program to play the game using a minimax search. The fact that deeper search will sometimes compensate for a less powerful evaluation function may make it possible for you to reduce the number of features while still writing a program that can play perfectly. If you complete this task, or even if you do not, you might like to think of a way to make the search much faster. This will be the subject of next month's article.

Good heavens a floppy disc!

CALCULATOR CORNER

This month Dick Pountain reviews two packages of software that are commercially available for use on programmable calculators.

Master pack

I have now received a production sample of the Master Pack set of programs for the Casio 501/502P briefly mentioned in an earlier Corner.

The Pack consists of a 54 page comb-bound User Manual and a cassette; it sells at a recommended price of £17.95.

The programs on the cassette consist of 15 originals, followed by the 120 odd Casio Program Library programs in the order printed. Incidentally it has come to my notice that a few early samples of the calculator were supplied with an inferior, earlier edition, program library which contains fewer programs and in a different order (which would make its use with the Master Pack very difficult indeed). The way to tell if you have this edition is that the first program is titled Mathematics O. In the later, superior, edition the first program is Mathematics I.

The Master Pack programs are identified only by spoken introduction (all have the same file no. 100) and the order in which they appear in the User Manual/Program Library. Users with a recorder which has a tape counter could make up their own counter reading index, but in any case it's recommended that frequently used programs be transcribed to a working cassette and the Pack kept as a master copy, to avoid damage.

The User Manual contains sections on basic and advanced programming which, though shorter than the Casio Manual, are more clearly and logically written, and will not insult the intelligence of anyone who has a minimal familiarity with programming. They do not include a key-by-key guide to the calculator so the absolute novice would best use them in conjunction with the Casio Manual.

The advanced section covers loops, labels and subroutines well, and goes into indirect operations in far more depth than the manufacturer's manual. It concludes with some original programming techniques for creating extra labels and program titles, data scrolling and prompts and display formatting which will be useful to "intermediate" standard users.

The manual also contains full documentation for the 15 original programs, and concludes with a key-code index and an explanation of telephone transmission of programs using a dictaphone type telephone pick up.

Of the 15 original programs included, 7 are games such as Lunar Lander, Bomber Pilot and Number Patience. They are all well thought out and make maximum use of the Casio's superior display capabilities. Of the rest, 7 are "utility" programs such as Reaction Timer, Price Comparator, Diet Calculator, and there's Electronic Scoreboard which replaces chips or money in card and board games such as Monopoly. The final program is the most interesting. It's a set of subroutines for data packing, which means creating a virtual array of addressable memories with less than 12 digit capacity. For instance, the 502 can be given the equivalent of 200 independently addressable single digit memories, or 100 two-digit memories. The data packing routines may be used manually or incorporated into user's programs. An obvious application is in statistical analysis of certain types and the routines are written so as to leave the statistics registers (M7, 8 and 9) free for this purpose. Some of the games use the data-packing technique to provide a 10 x 10 playing field which may be viewed by scrolling it line-by-line up the display. To this end a further routine is incorporated which generates a key-pad compass cursor to "steer" a target digit through the background field of 1s.

All things considered it's a useful package, not so much for the hobbyist who will probably write his own material, but for the professional user who needs frequent recourse to the Program Library material. It's rather a pity Casio didn't supply such a package themselves.

The pack should now be available in shops or from:— Premier Publications, 12 Kingscote Road, Addiscombe, Croydon, Surrey.

Broadwater economics simulations

These 5 programs (with 6 more to follow in the Spring of 1980) are designed as a teaching aid for A-level economics students and are the work of Graham Addis, an economics teacher.

The programs are written for Texas TI 58/59, Casio 501/502P and in BASIC, all three listings being supplied together with teachers and students notes and an explanation of the economics used, in booklet form. They may also be obtained on cassette or magnetic card.

Intended for use by a group of students, they demonstrate the dynamic behaviour of various Keynesian economic parameters (such as for instance the investment multiplier), without the need for the tedious arithmetical calculations which often can be an obstacle to the understanding of complex systems.

However, three of the programs — Fisgam, Poligam and Macropol — are simulations of the operation (massively simplified of course) of a whole economy, and as such are fascinating, even to the economic illiterate such as myself.

I found Macropol in particular quite engrossing. This simulates an island economy with no foreign trade. You are placed in the position of Chancellor of the Exchequer and by manipulating public expenditure and direct taxation, you attempt to control the economy, year by year. At each year end, you see the results of your "policies" on unemployment, inflation, investment, growth, capacity, consumption, budget deficit, income and stock disinvestment; then you try to do better next year! Although the model used reduces the economic relationships to a mere 9 equations, it nevertheless has sufficient realism to exhibit the sorts of economic fluctuation of which newspaper headlines have been made for the last 10 years. Although our present Monetarist Mentors would disagree, it seems likely that the sort of Keynesian theory illustrated in these models still provides the best description available of the workings of the modern industrial economy; certainly since 1945 it has significantly shaped the Institutions of the economic world in which we live.

Playing with Macropol for a few hours certainly gave me a small insight into the frighteningly sensitive and unstable nature of the feed-back systems which operate in the economy, and perhaps even gave me a little more sympathy for those much maligned administrators whose task is to tinker with it.

I'm sure that a very enlightening and demanding game could be contrived using Macropol where various players represent different "parties" and take turns to have five years in power, being judged by the "electorate" on their performance.

The 6 programs to be added later will all deal with the theory of the individual firm, with pricing, profitability and competition.

These programs are well presented, very reasonably priced at £1.50 each and will, I'm certain, be well received in the educational quarters at which they are aimed. It would be nice if they found some interest outside schools too; after all, economics affects all of us and certainly a good deal more than Alien Invasions or Lunar Landings.

All inquiries to:— Broadwater Economics Simulations, 24 Hill Barn Lane, Worthing, W. Sussex.

ON THE LINE

Breaking down the barriers to personal computer networks — David Hebditch brings us up-to-date on his "ongoing" tussle with the PO, by way of further extracts from the correspondence.

The Post Office connection ~Part 2

14th May, 1979 Letter to the Post Office.

Perhaps I could remind you that we are suggesting that users of personal computers be allowed to transmit over the public telephone network without type approval if the following conditions are met:

1 That only acoustic couplers should be used.

2 That the acoustic coupler employed should be fully type approved by the Post Office.

3 That any personal computer owner employing acoustic couplers as a means of transmitting data on the public network should register such use with their local telephone manager.

We look forward to hearing from you.

8th June 1979 Reply received from the Post Office.

My comments on your letter of the 14th February, are as follows:

1 I accept that in the circumstances outlined in your letter of 5th October, acoustically coupled modems could be required at both ends of a data transmission link and as such there are no policy objections provided that both modems are used itinerantly. I would hope, however, that users were aware that acoustic couplers are sensitive to background noise and therefore, if used at both ends of the link, will suffer additional transmission degradation. Consequently I must emphasise that the Post Office could in no way be held responsible for the correct transmission and receipt of data using such a system. Post Office responsibility is to ensure that speech communication is satisfactory.

2(a) As regards the question of voltages bridging the insulating gap I think that you and your advisers would agree, on reflection, that the degree of risk would depend upon the size of the voltage and insulating gap concerned. However, I am advised that in the field of personal computing the danger to the network from high voltages is remote and we are therefore, willing to withdraw for the time being the restriction referred to in paragraph 2a of my letter of 11 January.

2(b) The particular interference problem mentioned in my letter is that of converter-type (also known as 'switching') power supplies which can produce interfering frequencies of 20 KHz or more. However, this is only one aspect of the interference problem which can be produced by an undefined attachment to the acoustic coupler. I agree that the problem may not be caused by the coupler and I am therefore not insisting that this be solved by the coupler. However, if the coupler is unable to prevent the transmission to line of frequencies outside the limits laid down in Technical Guide No 32 it will be necessary for the terminals to be used with the coupler to be evaluated in conjunction with the coupler. This interference problem can, of course, as you point out, occur with electrically connected modems and I am becoming increasingly concerned with this aspect. However, the resources which we have at our disposal are limited and I have consequently decided that at the moment these resources can best be used by dealing with the more pressing problem , ie. acoustic couplers. By their very nature acoustic couplers are portable and being used in itinerant situations could cause interference on the PSTN which would be extremely difficult to trace.

3 If the acoustically coupled modem stands separately from the personal computer system and the interference problem can be overcome by incorporation of a suitable filter in the modem I can confirm that it will not be necessary for the computer system to undergo an evaluation. However, if the acoustic coupler does not protect the network adequately (paragraph 2[b] of my letter of 11 January refers) or the computer system has an integral modem, an evaluation of the terminal and the modem will be necessary. We will naturally have to react to any increase in the number of applications arising from clarification of this aspect of our policy. The level of evaluation fees raised will be commensurate with the resources employed by the Post Office and this should encourage developers and constructors to produce equipment which is likely to be readily acceptable to the Post Office, thereby minimising our charges.

4 In conclusion, I should like to add that the Post Office in no way wishes to inhibit developments in the sphere of personal computing and I agree that this is a potential source of revenue to the Post Office. However, my responsibility is to ensure, as far as is reasonably possible, that any private attachments to PO services will not adversely affect other users of PO services and this responsibility can only be discharged by our evaluation of private equipment. It may be that the development of an acoustic coupler which contained suitable filtering would be a reasonable solution to the particular problems which you have raised but I must leave this to the technicians to consider.

I am sorry for the delay in replying to you.

26th June 1979 Letter to the Post Office.

Many thanks for your letter of the 8th June. I am delighted to see that we are converging paths as far as this matter is concerned. However, one technical point seems to be outstanding. It is my understanding (and that of my technical advisers) that the 20 KHz interference caused by switching power supplies is a *radio* transmission. This is picked up by the exchange line acting as an antenna and is therefore, detectable by your engineers' oscilloscope.

However, it is difficult to see how such a signal could be transmitted across the telephone network which has a nominal bandwidth of only 300-3400 Hz. All frequencies above 3400 Hz are filtered out by Post Office equipment; there is no way in which filters in any type of modem (acoustically coupled or otherwise) could eliminate such a radio transmission. A faraday cage built around the DTE might. But if the 200 KHz cannot get beyond the exchange line. why is there a problem? I note with pleasure that you are prepared to waive type approval of personal computers working through acoustic couplers (subject to the resolution of the above problem). Now we seem to have most of the technical problems resolved, could you please clarify the regulatory aspects of usage? For example:

1 Will registration with local Telephone Managers be necessary?

2 Will any restrictions apply to the *type* of date which may be transmitted?

Please appreciate that I am not looking for trouble! However, I think it would be in everybody's interest if you could provide some form of statement which I could publish through my Personal Computer World 'On The Line' column. This could help to avoid misunderstandings at a later stage. I look forward to hearing from you again.

2nd July 1979 Received acknowledgement of my letter.

10th September, 1979 Letter to the Post Office requesting a reply.

11th October, 1979 Letter to the Post Office requesting a reply.

22nd October, 1979 Letter from the Post Office.

"Thank you for your further letter of 26th June concerning the outstanding points with regard to personal computer communications via the Public Switched

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ON THE LINE

Telephone Network (PSTN). I am sorry for the delay in replying.

You raised the question of interference and in particular interference at frequencies above 3400 Hz. Although the nominal frequency band generally offered over the PSTN is between 300 and 3400 Hz the Post Office network (including customer's local lines) is in fact capable of carrying much higher frequencies (which are incidentally not normally filtered out by PO exchange equipment as stated in your letter). This capability is, for example, utilized by the Post Office in the use of fdm carrier systems in the PO High Frequency (HF) network and in certain local network services. Consequently Technical Guide No 32 lays down frequency spectrum requirements not only for signals up to 3400 Hz (Diagram 3) but also above 3400 Hz (Diagram 4). The spectral roll-off characteristics of Diagram 4 are in particular designed to:

1 avoid interference with the PO HF network (by minimising crosstalk at higher frequencies, preventing over-spill into adjacent fdm channels).

2 avoid interference with services which exploit the HF capabilities of the local network.

3 prevent 'beat' signals produced by attachment signal harmonics and the 8KHz sampling frequency of wide-spread PCM systems.

In view of this explanation I hope you will accept that signals above 3400 Hz from attachments could cause network problems and interference to other users of PO services. It follows that the evaluation of the personal computer systems connected behind acoustically coupled modems will be necessary unless the modem involved incorporates suitable filtering.

With regard to the actual use of personal computers via acoustically coupled modems over the PSTN I confirm that it will be necessary for Post Office subscribers to first obtain the written consent of their local Telephone Area (Sales) Office.

As mentioned in my letter of 11 January the general conditions under which telephone service is provided and private attachments may be used are as laid down in the Post Office Telecommunication Scheme 1976 (and amendments). From the outline description of the system which you have supplied I do not envisage that any additional restrictions (other than the technical ones referred to above) will be required subject to the running of the systems falling within the ambit of the General Licence for Private Attachments to Post Office Telecommunication Installations which was published in the London Gazette on 1 July 1977.

I hope that this letter clarifies the outstanding issues and will enable you to offer the appropriate advice to personal computer users. The interference problem remains to be resolved of course, and I must leave you to consider how best to approach its resolution.

So that is where it presently stands. In case you got lost the current arrangement is as follows:

1 You can transmit data over the public telephone network using an approved acoustic coupler.

2 Your computer system does not need to receive Post Office type approval for this.

3 The only exception to points 1 and 2 above are those micro computers which employ switching board supplies. (I hope someone at Microsense is reading this).

4 You need to write to your local Telephone Area (Sales) Office to get their go-ahead first.

The only issue outstanding is that of the switching board supply. The Post Office clearly does not understand that this is caused by an electro-magnetic emanation from the board supply concerned and has nothing whatsoever to do with acoustic couplers. Indeed, the same problem will occur when using Post Office modems. Again the problem will occur if you are playing Star Trek on your Apple near a telephone line even if you have no communications equipment involved. I will pursue this matter further with the Post Office to try to get it resolved.

I now propose to try and persuade the Post Office to let us communicate through hardwired modems with the use of a barrier kit for safety reasons.

I will keep you posted *(sic)* on developments.

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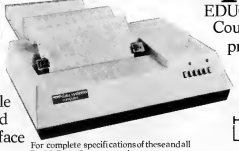

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Personal Computer World

PAST FEATURES: PART ONE

Here follows, a sectionalised breakdown of the contents of the earlier editions of Personal Computer World magazine — from Volume 1, Number 1 through to and including Volume 2, number 4.

Coming soon — Part 2 — which will include all remaining editions in the 2nd Volume. From then on we shall be publishing a list, cumulative issue by issue, for our current 3rd Volume. *Please Note: The following issues of PCW have completely sold out: Volume 1 Nos.4, 5, 9 & 12.*

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FORGING LINKS WITH THE OUTSIDE WORLD

The advent of the microprocessor and the relatively cheap personal computer has been accompanied by frenzied activity in many quarters to apply them in the obvious business and commercial fields — after all, most micros have to earn their living. Marketing of both software and hardware has been concentrated on the office environment . . . be it the accountant, the solicitor or the small business of any kind. Less well served have been the fields of industrial and laboratory instrumentation and control. Keen to correct this uneven investment of effort, Alan Mills and K.T. Kibase of 3D Digital Design and Development examine the design and "connective abilities" of the IEEE 488 bus.

A peep inside a 16-channel analogue to digital converter — typically used to handle signals from devices such as thermometers, pH meters and pressure transducers.

Understandably, any imbalance of microcomputer research stems largely from a lack of knowledge and experience on the part of both sellers and buyers. Now, however, the possibilities inherent in the combination of cheap computing power plus transducers, actuators, detectors, and instruments of various types is becoming all too apparent to many potential users. The great stumbling block, of course, is the interface. One can buy a computer in the region of £500, which is cheap enough for it to be installed as a dedicated controller, even if only for periods at a time; but how do you connect it up to the other devices?

The need for a standard interface has long been recognised, but international standards have lengthy gestation periods and take even longer to achieve general acceptance.

The one standard interface that is approaching respectable maturity is designated the IEEE-488 (1978). This is the bus that merits study by all computer users intent on extending beyond the processor-discs-printer triangle.

HERE COMES THE BUS

Also known as the General Purpose Instrumention Bus (GPIB), it was conceived by Hewlett-Packard, the instrument manufacturers; they proposed its adoption as an international standard to the Institute of Electrical & Electronic Engineers in America, and also to the International Electrotechnical Commission, back in 1974. In 1975 it was accepted as IEEE standard number 488, hence the designation IEEE-488 (1975). The revision of 1978 made only minor changes. The IEC standard is Publication No. 625-1.

Over the last few years an increasing number of instrument manufacturers have incorporated IEEE-488 interfaces into their products, following Hewlett-Packard's lead; nowadays it is becoming a common option.

The great breakthrough, as far as most readers are concerned, came with the launching of the Commodore PET. Designed with an integral IEEE-488 bus, it was aimed at the inexpensive end of the market — the hang glider to H-P's Concorde.

WHAT IS IT?

The bus consists of a set of 16 parallel wires (plus ground wires) along which signals are passed between devices that may be simultaneously connected. Eight lines are used for bit-parallel byte serial data transfers. Three lines are used to ensure orderly transfer of data by "handshaking" (i.e. signals going back and forth to synchronize transmission and reception — two-wire handshaking is the common rule, but with more than two devices connected together three wires become necessary). The remaining five lines are used for bus management functions.

Devices that can be connected to the bus are described either as "Talkers" (if they put information out onto the bus), "Listeners" (if they receive information from the bus), or "Controllers" (if in addition to Talking and/or listening, they take charge of the bus management functions).

Only one Controller may be active on the bus at any one time, although it is possible to have a bus without a Controller e.g. a Talker connected to two Listeners.

Also, to avoid confusion, only one Talker may be active on the bus at any one time, although it may be talking to more than one Listener.

As many as sixteen devices plus a Controller may be simultaneously connected in star, ring, or linear configurations. Each device has an address number (0 thru' 15) assigned to it.

A critical point to appreciate is that, generally speaking, Talkers only talk when the Controller has previously told them they may talk, and similarly Listeners only listen on previous instruction from the Controller.

The Controller can also de-activate devices on the bus by issuing UNLISTEN and UNTALK commands, known as

universal commands.

Examples of Talkers include paper-tape readers, analog-to-digital converters and keyboards. Paper-tape punches, X-Y plotters, digital-to-analog converters, stepper motors, and display devices are Listeners. Combined Talker/Listeners could be disc drives, tape cassette units, data loggers, and VDUs; at any instant they either talk, listen, or are de-activated.

The best example of a Controller is the CBM PET which can talk, listen and manage the bus.

In many applications the decisions about which device is to talk, which device(s) is (are) to listen, are made entirely by the Controller, so that, for example, the sequence of data transactions may be completely determined by the statements within a BASIC program running in a PET.

INTERRUPT FACILITIES

The bus is designed to permit a form of interrupt capability, in that a device may signal a SERVICE REQUEST (SRQ) by putting a logic level on the wire reserved for that purpose. On noticing that service has been requested the Controller must bring the present bus transaction to an orderly close, and then proceed to find out which device has interrupted. The protocol permits two ways of doing this, either by "Parallel Polling" (i.e. asking them all at once) or "Serial Polling" (asking for them each in turn).

Unfortunately, the CBM PET does not implement these latter features, or some of the other more sophisticated facilities of the bus protocol. It economises in other ways, too, departing in a number of minor instances from the recommended IEEE-488 standard (e.g. connector style). It should, in fairness, be noted that polling could be implemented in 6502 machine code, but this is only recommended to those who make a habit of treading boldly.

The PET, however, does have the tremendous advantage of addressing over the bus in BASIC, so that simple BASIC functions like PRINT and GET may be used in programs to put data out to or bring it in from external devices.

In fact, the internal architecture of the PET is such that its keyboard, two cassette ports, and screen, are treated as IEEE-488 devices with the first four device address numbers, 0 to 3, assigned accordingly. By logical extension, the Commodore discs and printer also use the IEEE-488 interface.

AREAS OF APPLICATION

With more people appreciating the usefulness of the IEEE-488 bus in the industrial and laboratory environments, the PET is becoming very popular with scientists and engineers as a machine that can be brought into contact with the outside world.

The drawback until recently has been that IEEE-488 instruments have tended to be fairly expensive, sometimes many times the price of a PET. Now, however, firms like 3D Digital Design & Development are making available a number of peripheral devices designed specifically for use with the PET form of the IEEE-488 bus, even down to using the same style of connection.

Analog voltage or current signals from whatever source may be sensed or monitored using a 16-channel analog-to-digital convertor unit. By simply connecting the voltage into a front panel socket of the unit, and connecting the unit to the PET with the double-ended bus cable, the voltage may be monitored by executing the following simple program:

```
10 OPEN 1,8,6
20 GET #1, A$
30 PRINT ASC (A$)
40 GO TO 20
```

Since the convertor is of 8-bit resolution the value printed to the screen will be between 0 and 256. The input amplifiers are usually set to, say, 5 volts in which case the conversion of the value back to a voltage is a simple matter of multiplying by the appropriate scaling factor ($\frac{5}{256}$). In the OPEN statement above, the device address (8) and channel number (6) are assigned to logical file no. 1.

An 8-channel 8-bit resolution digital-to-analog convertor unit allows analog voltages to be generated under program control by equally simple program statements, except that values are PRINTed out to the convertor unit. Each of the output channels has its own digital latch and digital-to-analog converter, so that a voltage sent to a channel stays there until changed from the PET.

Another interesting and useful device is a 16-channel relay closure unit containing 16 reed relays. The relay contacts are brought to front panel sockets with LED indicators to show the state of each relay. The relays may be set on or off in any desired sequence under program control by simple BASIC statements.

There is also a versatile digital data acquisition interface used for connecting up digital instruments which, although without an IEEE-488 interface, nevertheless provides digital output signals (as if often the case), such as digital voltmeters, frequency counters, transient recorders. This interface may also be used to monitor as many as 64 simple contact closures or logic levels.

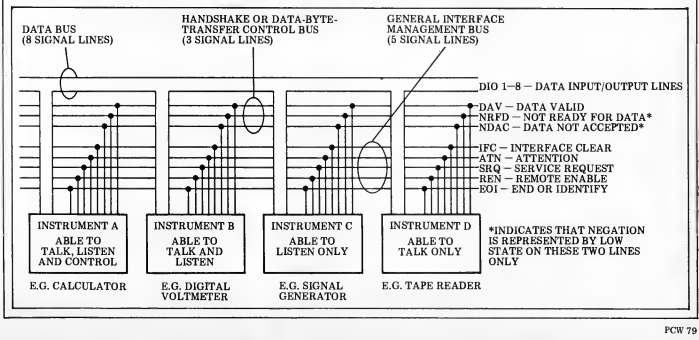
Any combination of these units can be simultaneously connected on the IEEE-488 bus, so that an enormous range of possible systems can be built up to monitor, indicate, measure, and control.

By introducing such a system into a small manufacturing plant, various levels of process automation can be achieved in a cheap and relatively painless way. Temperatures may be measured, indicator lamps switched on, heaters turned up, motors started, valves closed, shaft rotations counted — the possibilities are virtually limitless. The automation of testing, or of laboratory experiments, can be achieved with a minimum of time and effort if IEEE-488 compatible devices are chosen, and the PET is used as a controlling computer.

Indeed, the IEEE-488 is such a boon to the black art of interfacing that it will almost certainly be adopted by some future computers. Already the new Powerhouse II is available with the IEEE-488 interface.

The second half of this article, to appear soon, will take a look at actual case studies where the PET and IEEE-488 peripherals have been installed into working situations.

The IEEE-48 bus uses a 16-line cable to quickly link up any instruments equipped with appropriate interface circuitry into a system. Data transfer is byte-serial, bit-parallel at rates as high as 1 megabit per second.



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CHAPTER 6 DATA STRUCTURES 2 - RECORDS AND FILES

Computer programmers, the languages they program in and sometimes even the computers on which these programs run tend to be biased either towards number-crunching (immense calculations) or data-processing (huge quantities of information). This chapter is intended to provide an introduction to PASCAL's approach to the second of these.

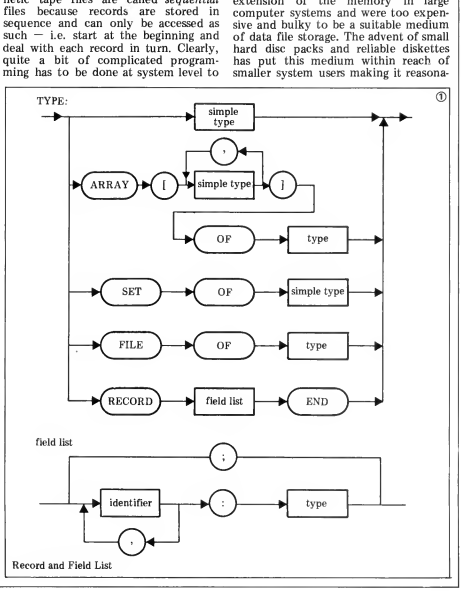
Computers have traditionally been employed in the fields of scientific research and business data-processing. The different requirements of these two types of user have produced opposing specialisms amongst computer professionals – conflicting designs and configurations of both hardware and software; and most importantly from our point of view, programming languages with differing facilities and capabilities. Scientific languages tend to standardize on specialized and sophisticated mathematical functions and to leave non-standard and bulk-data handling features which are consequently provided (with greater or lesser degrees of effectiveness) by the individual implementors of the language. This reflects perfectly reasonably the general format of a mathematical problem where complex operations need to be performed on a relatively restricted amount of data.

Commercial languages, however, often don't provide sophisticated or even convenient mathematical functions since their processing tends to consist of more routine operations but with much larger quantities of data. This is not to suggest that a good sorting algorithm is not every bit as complex as, say, a Fourier transform module, but while the latter operates *on* the supplied data to produce completely different data, the former works *with* data, re-ordering it but not actually changing any values. In any case, in a typical data-processing problem, the quantity of supplied data is generally so large that no more than a small fraction can fit into the machine at one time – the organizational problems associated with containing this data in machine-readable form and of making it available to the program in a controlled and ordered manner dominate these commercial languages.

While the data is being manipulated within the machine it is grouped together in structures called *records*. Loosely, a record is a number of data items, usually of different types, which need to be associated in some way, probably because they all pertain to a single entity. A second record would contain the corresponding information, in the same format, pertaining to another entity, and so on. An entry in a telephone directory, i.e. Name, Address . . . Telephone No. is a simple example of a record.

A *file* is a data structure external to the program and consists of a collection of records. The characteristics of any particular file will depend not only on the size and number of the records it is to contain, but also on the *medium* on which the file is being stored. Magnetic tape files are called *sequential* files because records are stored in sequence and can only be accessed as such – i.e. start at the beginning and deal with each record in turn. Clearly, quite a bit of complicated programming has to be done at system level to control the tape drive and the motion of data through the read/write tape heads. This software can usually be initiated by fairly simple calls embedded in the programming language. Wirth's standard PASCAL provides a set of these sequential file-handling facilities.

PASCAL, however, was designed when discs were considered as a sort of extension of the memory in large computer systems and were too expensive and bulky to be a suitable medium of data file storage. The advent of small hard disc packs and reliable diskettes has put this medium within reach of smaller system users making it reasona-



Record and Field List

```
 1  PROGRAM FIRSTILL ;                                          ②
 2  TYPE STOCK=RECORD
 3               NUMBER:INTEGER ;
 4               NAME:PACKED ARRAY [1..24] OF CHAR ;
 5               PRICE:REAL ;
 6               QUANTITY:INTEGER ;
 7               VAT:0..100
 8            END ; (*RECORD*)
 9  VAR ANSWER:CHAR ;
10      ITEM:ARRAY[0..4]OF STOCK ;
11      ACCEPTABLE:SET OF 'A'..'Z' ;
12      I:1..4 ;
13  PROCEDURE SETUP ;
14  BEGIN
15      ITEM[0].NAME := 'DAISY BELL PRINTER          ' ;
16      ITEM[1].NAME := 'MICRO DOT MATRIX PRINTER' ;
17      ITEM[2].NAME := 'NCR PAPER                   ' ;
18      ITEM[3].NAME := 'CONSTAT PAPER               ' ;
19      ITEM[4].NAME := 'CARBON RIBBON               ' ;
20      FOR I := 0 TO 4 DO
21        BEGIN
22          ITEM[I].NUMBER := I ;
23          ITEM[I].QUANTITY := 0 ;
24          PAGE (OUTPUT) ;
25          WRITELN ('PLEASE TYPE IN TODAY''S PRICE FOR ', ITEM[I].NAME) ;
26          WRITE ('FOLLOWED BY THE VAT RATE AS A % -->') ;
27          READ (ITEM[I].PRICE) ; READLN (ITEM[I].VAT)
28        END
29  END ; (*SETUP*)
30  PROCEDURE HELP ;
31    BEGIN
32      PAGE (OUTPUT) ;
33      WRITELN('TYPE H TO SEE THIS DISPLAY.') ;
34      WRITELN('       T TO PRODUCE A TILL SLIP.') ;
35      WRITELN('       S TO PRODUCE A SUMMARY OF THE DAY''S TRANSACTIONS.') ;
36      WRITELN('       E TO EXIT FROM THIS PROGRAM.') ;
37      WRITELN ; WRITELN ;
38      WRITE ('WHEN PRODUCING A TILL SLIP TYPE EACH ITEM NUMBER FINISHING ', ;
39      WRITELN('WITH A -1.') ;
40      WRITE ('HIT THE RETURN KEY TO CONTINUE.') ;
41      READLN
42  END ;(*HELP*)
43  PROCEDURE TILLSLIP ;
44  VAR TOTAL, TAX:REAL ;
45      NUM:INTEGER ;
46  BEGIN
47      TOTAL := 0 ;
48      TAX := 0 ;
49      READLN (NUM) ;
50      WHILE (NUM > -1) AND (NUM < 5) DO
51        BEGIN
52          WRITELN ((ITEM[NUM].NAME, '    ', ITEM[NUM].PRICE) ;
53          ITEM[NUM].QUANTITY:=ITEM[NUM].QUANTITY+1 ;
54          TOTAL:=TOTAL+ITEM[NUM].PRICE ;
55          TAX:=TAX+0.01*ITEM[NUM].VAT ;
56          READLN (NUM)
57        END ;
58      WRITELN ;
59      WRITELN('VAT          ',TAX) ;
60      WRITELN('TOTAL        ',TOTAL+TAX) ;
61      READLN
62  END ;(*TILLSLIP*)
63
64  PROCEDURE SUMMARY;
65  CONST TAB = '          ' ;
66  VAR TOTAL,TAX:REAL ;
67  BEGIN
68      TOTAL:=0 ;
69      TAX := 0 ;
70      PAGE (OUTPUT) ;
71      WRITELN('NAME                                QTY SOLD        AMOUNT') ;
72      FOR I:=0 TO 4 DO
73        BEGIN
74          WRITELN(ITEM[I].NAME, TAB, ITEM[I].QUANTITY, TAB,
75                  ITEM[I].QUANTITY*ITEM[I].PRICE) ;
76          TAX := TAX + 0.01*ITEM[I].VAT*ITEM[I].QUANTITY ;
77          TOTAL := TOTAL + ITEM[I].PRICE * ITEM[I].QUANTITY ;
78        END ;
79      WRITELN ; WRITELN ;
80      WRITELN ('SUBTOTAL = ', TOTAL) ;
81      WRITELN ('VAT = ', TAX) ;
82      WRITELN('TOTAL = ', TOTAL + TAX) ;
83      READLN
84  END ; (*SUMMARY*)
85  BEGIN (*MAIN PROGRAM*)
86      SETUP ;
87      ACCEPTABLE := ['E' , 'H' , 'S' , 'T'] ;
88      WRITELN ('TYPE H FOR HELP.') ;
89      REPEAT
90          READLN (ANSWER) ;
91          IF NOT (ANSWER IN ACCEPTABLE) THEN ANSWER := 'H' ;
92          CASE ANSWER OF
93            'E' : WRITELN ('GOOD BYE') ;
94            'H' : HELP ;
95            'S' : SUMMARY ;
96            'T' : TILLSLIP
97          END (*CASE*)
98      UNTIL ANSWER = 'E'
99  END .
```

ble to discuss direct-access files. As with the mag. tape drive, special system software is required to direct the read/write heads to the correct track and sector on the disc and to control the flow of data to and from this location. However, all the data is spread over the *surface* of the disc and is consequently all equally accessible *directly* — hence the name.

Although this software is utilized at operating system level (in the form of file-handling and/or editing utilities), high-level language calls are seldom available to the programmer so that most disc data-files tend to be sequential. UCSD PASCAL is an exception to this general rule and we feel that *direct-access* facilities are sufficiently important to be incorporated in *any* future standard PASCAL. It is with a small degree of reluctance therefore that we abandon Wirth PASCAL in Section 4 to describe the UCSD file-handling facilities.

Records

The record was defined in the previous section as a grouping of associated data items. These data items are known as the *fields* of the record. There is no restriction on the type which each field may be so that the structure is distinct from the array where all elements must be of the same type. In addition, fields are not directly accessible via computable indices like array elements, but must be referenced by a fixed *field identifier*.

The record is declared in a TYPE statement in which is stipulated both the field identifiers and their corresponding types. The syntax diagram in Box 1 shows the reserved words required for this declaration, together with the format for the *field list*. Note that a field within a record could be another record, or even an array.

As an example of the uses of records in a program look at program FIRSTILL in Box 2. The program represents a cash register for a small shop which sells printers and stationery for microcomputers. A tally is kept of every sale so that, in addition to producing a slip for the customer, a daily summary can be output at closing time. The record type STOCK is declared in lines 2 to 8 with the field list laid out in lines 3 to 7. The field NAME is declared as a PACKED ARRAY. *Packing* is a device whereby elements of a particular data type are packed into the smallest amount of memory needed — e.g. a bit for a BOOLEAN, a byte for a CHAR etc. Numerical array elements frequently incur a large an overhead to make packing worthwhile but BOOLEANs and CHARs usually repay packing with substantial space saving. The PACKED ARRAY OF CHAR is formally defined as a *string* which we shall be dealing with at some length in the next chapter.

In line 10, array ITEM is declared as of type STOCK which implies that 5 records will be set aside in memory for this data structure. Each record can be referenced by a different value of the array index. Line 15 and the rest of procedure SET UP provide illustrations of the method by which individual fields within a record are referenced. The record name and the field name, separated by a . , must both be supplied, and lines 15 to 19 refer to the same field in different records. Lines 22 and 23 on the other hand refer to different fields in the same record (selected by I). The instruction in line 24 clears the screen (in UCSD PASCAL).

Lines 25 to 27 reflect today's uncertain commercial climate by offering the user an opportunity to input altered prices and VAT rates.

Procedure HELP reveals the menu-driven nature of the program, since each of the different functions may be selected by inputting a single character at the keyboard. The most important key to remember, especially for an inexperienced teller, is 'H' which executes HELP itself. The two procedures TILLSLIP and SUMMARY show how record fields can be manipulated like ordinary variables although the referencing scheme makes them appear a bit long-winded. This can be avoided by means of the WITH statement whose syntax diagram is given in Box 3. When the record identifier is given in the "variable" box, all identifiers appearing in the "statement" are checked by the compiler against the field names pertaining to that record as well as the normal declared identifiers appropriate to that procedure. The record name is thus taken as a *default* for the duration of the statement. This is illustrated in the new version of SUMMARY appearing in Box 4, lines 10 to 15.

Exercise: Re-write FIRSTILL using WITH statements where appropriate.

Files

One of the essential characteristics of a file is that it is external to the program as a whole. Only a small portion of the data is accessible to the program at any one time and although it is possible to have a file of arrays, say, we will assume that a typical file contains records. In this section we are discussing the sequential files of Wirth PASCAL as defined in the introduction so that the file will consist of a *sequence* of records in strict order. When a file is accessed therefore, the "unit" in which the program must deal with the data is one record.

A file is declared by means of a type statement as shown in the syntax diagram of Box 1. In our case, the "type" referred to in the declaration will be a record which will have been declared earlier on in the declaration part. When the compiler encounters the file declaration, apart from noting the *file identifier* and establishing the correct I/O channel (and peripheral) on which the file is to be found, it creates a structure in memory of exactly the type (i.e. record) previously defined. This structure is known as the *file window* or *buffer variable* and is referenced as follows;

file identifier ^
or file identifier ↑

depending on the character set supported by your terminal.

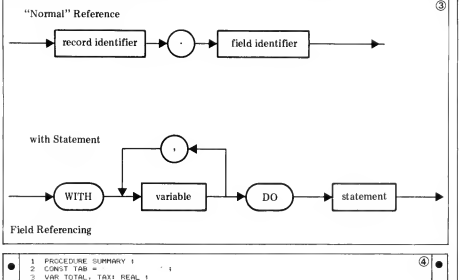
During execution of the ensuing program, any reference to "file identifier ↑" will involve those memory locations set aside for that structure. It is the job of the programmer, however, to ensure that the *contents* of these locations are in fact the fields of the record under consideration. For this purpose there are a number of *file-handling operators* available. These enable the programmer to manipulate the peripheral on which the file is stored and so access the data needed.

The file-handling operators are

RESET (filename) — starts at the beginning of the file and puts the first record into the buffer variable. This is used when *reading* data out of a file.
REWRITE (filename) — starts at the beginning of a new file or out-of-date file for the purpose of *writing* to the file. Nothing is actually written on the file at this stage, however.
GET (filename) — advances the file window by one record and assigns the data contained therein to the buffer variable.
PUT (filename) — writes contents of buffer variable out to file — i.e. creates a new record at the end of the file.

In addition to the file window, another file control element is maintained in the machine while file operations occur. This is a BOOLEAN variable called EOF (for end-of-file) which is FALSE as long as there are unaccessed records still in the file and becomes TRUE when the last record is reached. When a RESET is executed, EOF is made FALSE unless no file can be found. When a REWRITE is executed EOF is made TRUE. A GET won't work unless EOF is FALSE beforehand and a PUT won't work unless EOF is TRUE before-

③



④

```
 1  PROCEDURE SUMMARY ;
 2  CONST TAB =                 ' ;
 3  VAR TOTAL, TAX: REAL ;
 4  BEGIN
 5      TOTAL := 0 ;
 6      TAX := 0 ;
 7      PAGE (OUTPUT) ;
 8      WRITELN ('NAME                              QUANTITY SOLD        AMOUNT ' ) ;
 9      FOR I := 0 TO 4 DO
10        WITH ITEM[I] DO
11          BEGIN
12            WRITELN(NAME, TAB, QUANTITY, TAB, QUANTITY*PRICE) ;
13            TAX := TAX + 0.01*VAT*QUANTITY ;
14            TOTAL := TOTAL + QUANTITY*PRICE
15          END ; (*WITH*)
16      WRITELN ; WRITELN ;
17      WRITELN ('SUBTOTAL = ', TOTAL) ;
18      WRITELN ('VAT =    ', TAX) ;
19      WRITELN ( TOTAL = ', TOTAL + TAX) ;
20      READLN
21  END ; (*SUMMARY*)
```

⑤

```
 1  PROGRAM BIGTILL ;
 2  CONST MAX = 100 ;
 3  TYPE STOCK = RECORD
 4                 NUMBER : INTEGER ;
 5                 NAME : STRING[25] ; (* UCSD ONLY *)
 6                 PRICE : REAL ;
 7                 TOTQUANTITY : INTEGER ;
 8                 QUANTITYSOLD : INTEGER ;
 9                 REORDERLEVEL : INTEGER ;
10                 VAT : 0..100
11               END ; (*RECORD*)
12  VAR ANSWER, OLD : CHAR ;
13      ITEM : ARRAY [1..MAX] OF STOCK ;
14      STOCKFILE : FILE OF STOCK ;
15      ACCEPTABLE : SET OF 'A'..'Z' ;
16      DAYTAX, DAYTOTAL : REAL ;
17      TOTNUM : INTEGER ;
18
19  PROCEDURE SETUP ;
20  VAR I : INTEGER ;
21  BEGIN
22      I := 1 ;
23      RESET (STOCKFILE, 'RECORDS.DATA' ) ;
24      WHILE NOT EOF (STOCKFILE) DO
25        BEGIN
26          ITEM[I] := STOCKFILE^ ;
27          I := I + 1 ;
28          GET (STOCKFILE)
29        END ;
30      CLOSE(STOCKFILE,LOCK) ;
31      TOTNUM := I - 1
32  END ; (*SETUP*)
33
34  PROCEDURE INITIALISE ;
35  VAR I, NUM : INTEGER ;
36  BEGIN                                  '
37      WRITE('HOW MANY DIFFERENT ITEMS WILL BE SOLD --: ' ) ;
38      READLN (TOTNUM) ;
39      REWRITE (STOCKFILE, 'RECORDS.DATA') ;
40      FOR I := 1 TO TOTNUM DO
41        WITH STOCKFILE^ DO
42        BEGIN
43          NUMBER := I ;
44          WRITE( NAME -->') ;
45          READLN (NAME) ;
46          WRITE ( 'PRICE --> ' ) ;
47          READLN (PRICE) ;
48          WRITE ('STOCKLEVEL -->') ;
49          READLN (TOTQUANTITY) ;
50          QUANTITYSOLD := 0 ;
51          WRITE ('REORDER LEVEL -->' ) ;
52          READLN (REORDERLEVEL) ;
53          WRITE ('VAT AS A %  -->' ) ;
54          READLN (VAT) ;
55          PUT (STOCKFILE)
56        END ; (*WITH*)
57      CLOSE(STOCKFILE,LOCK) ;
58      SETUP
59  END ; (*INITIALISE*)
60
61  PROCEDURE WRITEFILE ;
62  VAR I : INTEGER ;
63  BEGIN
64      REWRITE (STOCKFILE, 'RECORDS.DATA') ;
65      FOR I := 1 TO TOTNUM DO
66      BEGIN
67          STOCKFILE^ := ITEM[I] ;
68          PUT (STOCKFILE)
69      END ;
70      CLOSE(STOCKFILE,LOCK)
71  END; (*WRITEFILE*)
72
```

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@ 132 char,/line	42	40		64	21
Parallel and RS-232 serial interfaces standard	YES	NO	NO	NO	NO
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```
 73  PROCEDURE TILLSLIP ;                                    5 cont'd
 74  VAR TOTAL, TAX : REAL ;
 75      NUM : INTEGER ;
 76  BEGIN
 77      TOTAL := 0 ;
 78      TAX := 0 ;
 79      READLN (NUM) ;
 80      WHILE (NUM > 0) AND (NUM <= TOTNUM) DO
 81          WITH ITEM[NUM] DO
 82          BEGIN
 83              WRITELN(NAME, ' ', PRICE) ;
 84              TOTQUANTITY := TOTQUANTITY - 1 ;
 85              QUANTITYSOLD := QUANTITYSOLD + 1 ;
 86              TOTAL := TOTAL + PRICE ;
 87              TAX := TAX + 0.01*VAT*PRICE ;
 88              READLN (NUM)
 89          END (*WITH*) ;
 90      DAYTAX := DAYTAX + TAX ;
 91      DAYTOTAL := DAYTOTAL + TOTAL ;
 92      WRITELN ;
 93      WRITELN ('VAT      ', TAX) ;
 94      WRITELN ('TOTAL    ', TOTAL + TAX) ;
 95      READLN
 96  END ; (*TILLSLIP*)
 97
 98  PROCEDURE DAYSTILL ;
 99  BEGIN
100      WRITELN ('SUBTOTAL = ', DAYTOTAL) ;
101      WRITELN ('VAT =      ', DAYTAX) ;
102      WRITELN ('TOTAL =    ', DAYTOTAL + DAYTAX) ;
103      READLN
104  END ; (*DAYSTILL*)
105
106  PROCEDURE WEEK ;
107  VAR I : INTEGER ;
108  BEGIN
109      WRITELN('NUMBER      NAME          PRICE        STOCK   SOLD  REORDER  VAT');
110      FOR I := 1 TO TOTNUM DO
111          WITH ITEM[I] DO
112          BEGIN
113              WRITE(NUMBER,'      ',NAME,'      ',PRICE,'      ') ;
114              WRITELN(TOTQUANTITY, '      ',QUANTITYSOLD) ;
115              IF REORDERLEVEL>TOTQUANTITY - QUANTITYSOLD
116              THEN WRITE ('      Y      ')
117              ELSE WRITE ('      N      ') ;
118              WRITELN (VAT) ;
119              QUANTITYSOLD := 0
120          END (*WITH*) ;
121      READLN
122  END ( *WEEK*) ;
123
124  PROCEDURE AMENDFILE ;
125  VAR NUM, FIELD : INTEGER ;
126      CONT : CHAR ;
127  PROCEDURE RECMENU ;
128  BEGIN
129      WRITELN('TYPE 0 FOR NO CHANGES.') ;
130      WRITELN('      1 TO ALTER A NAME.') ;
131      WRITELN('      2 TO ALTER A PRICE.') ;
132      WRITELN('      3 TO ALTER A CURRENT STOCK LEVEL.') ;
133      WRITELN('      4 TO ALTER A WEEKLY SALES LEVEL.') ;
134      WRITELN('      5 TO ALTER A REORDERING LEVEL.') ;
135      WRITELN('      6 TO ALTER A VAT RATE.') ;
136      READLN
137  END ; (*RECMENU*)
138
139  PROCEDURE NOCHANGE ;
140  BEGIN
141      WRITELN (' NO CHANGES MADE. ') ; READLN
142  END ; (*NOCHANGE*)
143  PROCEDURE NAMECHANGE ;
144  BEGIN
145      WRITELN ('OLD NAME -->', ITEM[NUM].NAME) ;
146      WRITE ('NEW NAME -->') ;
147      READLN (ITEM[NUM].NAME)
148  END ; (*NAMECHANGE*)
149
150  PROCEDURE PRICECHANGE ;
151  BEGIN
152      WRITELN ('OLD PRICE -->', ITEM[NUM].PRICE) ;
153      WRITE ('NEW PRICE -->') ;
154      READLN (ITEM[NUM].PRICE)
155  END ; (*PRICECHANGE*)
156
157  PROCEDURE TOTCHANGE ;
158  BEGIN
159      WRITELN ('OLD STOCK LEVEL -->', ITEM[NUM].TOTQUANTITY) ;
160      WRITE ('NEW STOCK LEVEL -->') ;
161      READLN (ITEM[NUM].TOTQUANTITY)
162  END ; (*TOTCHANGE*)
163
164  PROCEDURE SOLDCHANGE ;
165  BEGIN
166      WRITELN ('NUMBER SOLD -->', ITEM[NUM].QUANTITYSOLD) ;
167      WRITE ('NEW NUMBER SOLD -->') ;
168      READLN (ITEM[NUM].QUANTITYSOLD)
169  END ; (*SOLDCHANGE*)
170
171  PROCEDURE ORDERCHANGE ;
172  BEGIN
173      WRITELN ('OLD REORDERING LEVEL -->', ITEM[NUM].REORDERLEVEL) ;
174      WRITE ('NEW REORDERING LEVEL -->') ;
175      READLN (ITEM[NUM].REORDERLEVEL)
176  END ; (*ORDERCHANGE*)
177  PROCEDURE VATCHANGE ;
178  BEGIN
179      WRITELN ('OLD VAT RATE -->', ITEM[NUM].VAT) ;
180      WRITE ('NEW VAT RATE -->') ;
181      READLN (ITEM[NUM].VAT)
182  END ; (*VATCHANGE*)
183  BEGIN (*AMENDFILE*)
184      REPEAT
185          REPEAT
186              WRITE ('RECORD NUMBER -->') ;
187              READLN (NUM)
188          UNTIL (NUM>0) AND (NUM <= TOTNUM) ;
189          WITH ITEM[NUM] DO
190          BEGIN
191              RECMENU ;
192              READLN (FIELD) ;
193              IF (FIELD > 6) OR (FIELD < 0) THEN FIELD := 0 ;
194              CASE FIELD OF
195                  0 : NOCHANGE ;
196                  1 : NAMECHANGE ;
197                  2 : PRICECHANGE ;
198                  3 : TOTCHANGE ;
199                  4 : SOLDCHANGE ;
```

hand. This makes it impossible to write a record into the middle of a file.

PROGRAM BIGTILL in Box 5 is an expanded version of FIRSTILL. In FIRSTILL, the data was input at the beginning of each program run. This may be acceptable for a shop that sells five items, but for one that sells fifty it would be a tedious and time consuming process. BIGTILL differs from FIRSTILL in that the records are held on disc in a file (called RECORDS.DATA), loaded into memory at the start of each day's transactions and copied back at the end of each day. Throughout the day the records are held in memory in array ITEM.

In FIRSTILL, PROCEDURE SUMMARY produced the day's results. In BIGTILL results are produced weekly by PROCEDURE WEEK (lines 106 through 122). As it's important to know what should be in the till at the end of each day PROCEDURE DAYSTILL (lines 98 through 104) is provided. PROCEDURE TILLSLIP (line 226) and DAYTAX (line 226) keep tabs of the shop's money and the government's money respectively.

Upon starting up the execution of the program the user is asked if there is an old file (line 227). If the answer is yes, PROCEDURE SETUP (lines 19 through 32) opens the file (line 23) and gets the first record. Note that RESET takes two parameters — the identifier STOCKFILE and the string RECORDS.DATA (which actually appears in the system directory). The second parameter is required by UCSD PASCAL and is not required in standard PASCAL. In lines 24 through 29 each record is read, one at a time, from the STOCKFILE into ITEM. The loop is terminated when the End of File marker is hit (line 14). Line 30 contains another reserved word, CLOSE, that is needed only in UCSD PASCAL. In this version of PASCAL files must be closed before the next RESET or REWRITE can occur. CLOSE(X) deletes X as well as closing it while CLOSE(X, LOCK) retains X in the directory.

If the user does not have a file, then PROCEDURE INITIALISE (lines 34 through 59) is called. In line 39 the STOCKFILE is opened for writing. (Note that RECORDS.DATA is only needed by UCSD PASCAL.) For each record, the FOR DO loop (lines 40-56) reads each field into a record STOCKFILE↑ and then writes this record (line 55) to STOCKFILE. Since this process does not put the information into ITEM it is necessary to call SETUP (line 58) to read the new discfile into memory.

PROCEDURE WRITEFILE (lines 61 through 71) opens the STOCKFILE for writing (line 64) and then in the FOR DO loop (lines 65 through 69) assigns each element of the array ITEM into the file window STOCKFILE↑ so that it can be written to the file (line 68). In fact, line 67 (and line 26) shows one of the major advantages of having a record structure. Assignment of one record to another of the same type can be done in a single statement. This is true even if the fields of the record contain records, sets and arrays.

PROCEDURE AMENDFILE (lines 124 through 209) allows the user to alter any of the information in array

```
200                 5 : ORDEXCHANGE ;                    5 cont'd
201                 6 : VATCHANGE
202               END (*CASE*)
203
204         END (*WITH*) ;
205         WRITE ('MORE CHANGES, TYPE Y OR N ---> ') ;
206         READLN (CONT)
207       UNTIL CONT = 'N' ;
208       WRITEFILE (*NOT ESSENTIAL BUT DONE TO MINIMIZE EFFECTS OF A SYSTEM CRASH*)
209     END ; (*AMENDFILE*)
210
211   PROCEDURE HELP ;
212   BEGIN
213     PAGE (OUTPUT) ;
214     WRITELN ('TYPE H TO SEE THIS DISPLAY') ;
215     WRITELN ('       T TO PRODUCE A TILL SLIP') ;
216     WRITELN ('       D TO PRODUCE THE DAY'S TILL TOTALS') ;
217     WRITELN ('       W TO PRODUCE A SUMMARY OF THE WEEK'S SALES ) ;
218     WRITELN ('       E TO EXIT FROM THIS PROGRAM') ;
219     WRITELN ('       A TO ALTER THE STOCKFILE') ;
220     READLN
221   END ; (*HELP*)
222
223   BEGIN (*MAIN PROGRAM*)
224     ACCEPTABLE := ['A', 'D', 'E', 'H', 'W', 'T'] ;
225     DAYTOTAL := 0 ;
226     DAYTAX := 0 ;
227     WRITE ('DOES A FILE ALREADY EXIST, TYPE Y OR N ---> ') ;
228     READLN (OLD) ;
229     IF OLD = 'Y'
230     THEN SETUP
231     ELSE INITIALISE ;
232     WRITELN ('TYPE H FOR HELP.') ;
233     REPEAT
234       READLN (ANSWER) ;
235       IF NOT (ANSWER IN ACCEPTABLE) THEN ANSWER := 'H' ;
236       CASE ANSWER OF
237         'A' : AMENDFILE ;
238         'D' : DAYSTILL ;
239         'E' : BEGIN WRITEFILE ; WRITELN ('GOOD BYE') END ;
240         'H' : HELP ;
241         'T' : TILLSLIP ;
242         'W' : WEEK
243       END (*CASE*) ;
244     UNTIL ANSWER = 'E'
245   END.
```

```
1   PROCEDURE TILLSLIP ;                                  6
2   VAR TOTAL, TAX : REAL ;
3       NUM : INTEGER ;
4   BEGIN
5     TOTAL := 0 ;
6     TAX := 0 ;
7     READLN (NUM) ;
8     WHILE NUM <> -1 DO
9     BEGIN
10      SEEK (STOCKFILE, NUM) ;
11      GET (STOCKFILE) ;
12      WITH STOCKFILE^ DO
13      BEGIN
14        WRITELN (NAME, '  ', PRICE) ;
15        QUANTITYSOLD := QUANTITYSOLD + 1 ;
16        TOTQUANTITY := TOTQUANTITY - 1 ;
17        TOTAL := TOTAL + PRICE ;
18        TAX := TAX + (PRICE*VAT) ;
19        SEEK (STOCKFILE, NUM) ;
20        PUT (STOCKFILE) ;
21        READLN (NUM)
22      END (*WITH*)
23    END ;
24  END ; (*TILLSLIP*)
```

Look up table

Computer jargon
File-handling
Sequential File
Direct Access File
Records
Fields
Master File
File window — Buffer Variable
Update
Packing
Peripheral
Default

PASCAL Reserved Words
RECORD
WITH — DO
FILE — OF
RESET
REWRITE
GET
PUT
EOF

UCSD Excpetions
See Sections 3 & 4
SEEK
CLOSE

Exercises
(i) Rewrite FIRSTILL using WITH
(ii) Rewrite BIGTILL using SEEK

ITEM. This allows for the correction of mistakes made, as well as for changing the stockfile levels when stock comes into the shop or "walks". In line 208 PROCEDURE WRITEFILE is called to make the changes permanent. It isn't essential to do this, since before exiting from the program for the day, the file is written to disc (line 239); it's a precaution to prevent the loss of data if the system crashes.

Compared with handling ordinary variables, the business of file-accessing is clearly rather awkward in programming terms. In particular, where large files of textual materials are concerned, PASCAL supports a number of specialized features. These will be dealt with in our subsequent chapter on word-processing.

Direct Access file handling

Up to this section all the examples have dealt with sets of data that could be completely held in main memory while processing occurred. With memory prices decreasing generally and the new 16-bit micros with their enormous address spaces coming on the market, many applications will actually be able to keep their data in main memory in this way. However, if one isn't planning to purchase a Z8000 with a megabyte of RAM there probably will come a time when the amount of data required is too large for the memory available. In this case files are kept on disc (or tape) and only the record currently being processed will be in memory. As access speeds on disc are very much slower than those of main memory, every effort has to be made to minimize access time.

When data is held in main memory, the data can be updated during each transaction. When the data is held in sequential files, however, such alteration is more complicated. The file must be copied over into a new file, one record at a time. When the record to be altered is reached, it is brought into memory, amended and then written out into the new file. The rest of the file is then transferred as before. Although this technique ensures that the data being accessed is always up-to-date, the delay between transactions would be of the order of minutes for any reasonably sized file. In consequence, sequential files are not usually updated in this way. Instead, a *secondary* file with the update information is established and all alterations over some period (e.g. a day) are collected. At the end of the period the *master* file is updated. Unfortunately, as this period drags on, the master file becomes progressively more inaccurate and in some applications (e.g. airline reservation systems) such out-of-date information is completely unacceptable, although in our till program, the name, price and VAT rating of the stock are likely to be constant over longer periods of time.

If PASCAL is to become acceptable as a viable language for data processing, it will have to offer the more convenient direct-access facilities associated with disc-based backing store rather than the current standard tape-based sequential access methods. We hope that the standards bodies currently working on PASCAL will take this into account. In the meantime we have taken the liberty of discussing the UCSD implementation of these features which, although non-standard, are widely available on micros.

SEEK is a UCSD reserved word that will search out an individual record from a disc file. SEEK requires two parameters, the first being the file identifier, and the second, an integer representing the record number to which the window must be moved. The first record of a UCSD direct-access file is number 0.

If STOCKFILE in program BIGTILL became so large that the internal array ITEM could not fit into the available memory, several changes would be necessary in the program. Since only one record would be present in memory, the array ITEM would become superfluous. Procedure TILLSLIP in BOX 6 is a rewrite of the version in Box 6. Line 10 locates the required record while line 11 reads it into the window STOCKFILE^. STOCKFILE in line 12 corresponds to ITEM[NUM] of line 81 Box 5. After the information has been accessed and altered (lines 14-18) the amended record is copied back into STOCKFILE. Line 19 is necessary because a GET moves the window forward one record, so that PUT in line 20 would otherwise overwrite the (NUM + 1)th record rather

than the NUMth.

Exercise: Re-write BIGTILL for a direct access master file.

Conclusion

Different methods of file-access and their relation to the different media on which the information is stored have been discussed. It would be misleading to pretend that "normal" data processing programs are as trivial as the examples we have discussed, but we hope that they have been sufficiently realistic at least to illustrate the concepts involved.

Finally, our thanks to Equinox Computer Systems for the loan of a 56K Horizon with UCSD PASCAL — on which we tested the programs.

Bookfare cont. from p55

but only after discussing various options, so that the reader is given the information on which to make a sensible choice.

Brown's apt and witty style enables him to emphasise the importance of the "boring" but vital elements of compiler writing, like a considerate, user-friendly interface, good documentation and adequate standards. He does this in a way which cannot be ignored and cannot be dismissed as worthy but irrelevant doctrine.

Most of the deadly sins relate to thoughtlessness in providing suitable user facilities: do not treat error diagnosis as an afterthought and do not leave users to find the errors in your compiler, are sins number 5 and 13, and the eleventh and perhaps most deadly one is "to rate the beauty of mathematics above the usability of your computer". The deadly sins are used as landmarks and reminders to help the reader follow Brown's coherent and comprehensive description of the main aspects of compiler techniques.

Brown's excellent book casts a shadow over another book which has been published recently, one which sets out to perform a similar function — *Richard Bornat's Understanding and Writing Compilers.*

Although the dustjacket claims that computer hobbyists will find Bornat's book "of interest", it is far too academic and heavy going in comparison to Brown's work. Bornat goes into greater detail than Brown into compiler writing techniques and his book is orientated to languages like Algol 68 and Pascal.

I read Bornat after Brown, which is a useful sequence for somebody wishing to explore Brown's insights further. But the legibility of Bornat's text is hampered by the fact that it has been typeset using a Diablo printer which I found a strain and added to my feeling of dense concentration of information, in comparison to Brown's souffle.

Eine kleine byte musik

One of the first applications of digital program control was the music-roll pianolas or "reproducing piano player". That was in the 1920s, long before the first expensive fiddling about with computer music in the 1950s and 60s and the more recent micro music explosion.

The Byte Book of Computer Music provides an interesting and illuminating survey of the scope and practicability of computer music. Its seventeen articles range from a look at those early reproducing pianos through to an assortment of music chips, Fourier Transforms and a $19 music interface. There is also a trip to the musical fringes of the 20th Century with a program which translates contour maps into music.

Most of the articles first appeared in Byte magazine in the last few years but six have been specially commissioned, including ones on singing KIMs and musical Altair 8800s.

There is plenty in the book to stir the imagination and to give practical hints to what the book's editor Christopher Morgan, calls the "new generation of music enthusiasts, would-be musicologists and fugue fanciers" who are sampling the "delights of digital music synthesis."

Books discussed in this month's Bookfare have been

Running Wild by Adam Osborne (Osborne/McGraw-Hill, £2.95)

Writing Interactive Compilers and Interpreters by P.J. Brown (John Wiley & Sons, £9.75).

Understanding and Writing Compilers by Richard Bornat (Macmillan, £5.95 paperback, £12.00 hard cover).

The Byte Book of Computer Music edited by Christopher P. Morgan (Byte Books, £6.75 — available from LP Enterprises)

CHECKOUT
VIDEO GENIE

A Video Genie materialized at PCW recently — courtesy of Lowe Electronics; Z-80 based, it's fully compatible with the TRS-80 level II. The machine, an integral processor, keyboard and cassette drive, plugs into the domestic TV and is no bad way of "getting into" computing.

It has a socket for attachment of an external cassette, quite useful if you encounter load problems, as I did. It seems that some of the commercially available tapes, while being suitable for the TRS-80, need some means of volume adjustment on the Genie.

We lent the machine to Ian O'Neill (who has used a TRS-80 for some time now) to see what he thought of it. Here are some of his comments:

"The built-in cassette recorder worked well and cut down the number of leads needed to connect the system to the mains and to other units. It also offered a manual/computer control switch, ideal for rewinding etc. All the TRS-80 programs from my own system loaded perfectly, both on the internal cassette and on an externally connected one. I also liked the built-in power supply."

One or two things are worth mentioning in addition to Ian's comments. It has a double width character switch which stretches the characters that appear on the screen, thus making editing much less of a strain on the eyes. There is a reset button tucked away behind the keyboard which resets the machine when and if it locks. This can happen if reading a poorly recorded tape for example. Finally, the S100 bus ensures compatibility with a wide range of peripheral devices. Returning to Ian's comments, he also noticed a few things that he didn't like:

"The monitor I used had a severe attack of the shakes when attached to the Genie, and I also failed to get it to work with either of our domestic televisions. It seems that I should have tuned them in, something I didn't realise at the time. Perhaps the instructions could be clarified. I found the convention of calling the return key "new line" repulsive — I don't know why, I even prefer ' enter '. Ah well, it's not that important I suppose. One fairly serious omission from the keyboard was a ' clear ' key; and, despite the assurances of the sales blurb, I could find no justification for the claim of ' full cursor controls '; there is only backspace and new line.

The manuals, although first attempts, appear sufficient and are probably easier on the inexperienced owner than the detailed, though excellent, TRS-80 Level II manual. The literature seems to have been written with the American user in mind and hence it is over-simplified in places and littered with bad grammar and American spelling.

"The BASIC is very compatible with that of the TRS-80 as is shown by the benchmark timings (in seconds), which are as follows:

BM1: 2.7, BM2: 11.6, BM3: 28.0, BM4: 28.5, BM5: 31.3, BM6: 51.9, BM7: 51.0, BM8: 11.7

One final thing — numeric keypad freaks will be sorry to hear that there is no convenient place on the Video Genie to fit a keypad, as there is on a TRS-80. This is not a major disadvantage, however, as these devices are mainly a "keeping up with the PETs' gimmick."

Our view of the system is that it is an economical way of "getting into" personal computing. Its main disadvantage is that if you use the family telly, as I do, then either the family has to prefer watching you playing with the computer or your computing time will be severely curtailed in the interests of domestic harmony. — *David Tebbutt*

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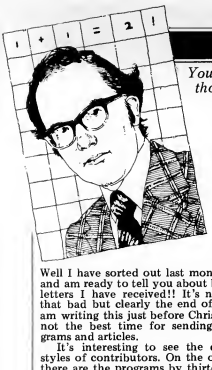
YOUNG COMPUTER WORLD



Young Computer World is the place where, each month, John Coll highlights the thoughts, ideas and contributions of PCW's younger readers.

Well I have sorted out last months mail and am ready to tell you about both the letters I have received!! It's not quite that bad but clearly the end of term (I am writing this just before Christmas) is not the best time for sending in programs and articles.

It's interesting to see the different styles of contributors. On the one hand there are the programs by thirteen year olds that arrive accompanied by an immaculately typed letter, on the other hand there are short programs by fifteen year olds neatly written out on scraps of paper! I strongly prefer the latter, where there has been rather less adult influence! People often think that you have to spend hours writing an article — not so. A good idea can be jotted down in a few minutes and it really doesn't matter how perfect the typing is. By the time I have knocked it around and Dave Tebbutt (the Technical Editor) has topped and tailed my offering, it's often only the idea and the actual program that survive.

Acorns

Paul Durrant (15) of Norwich has sent in a small machine code program for the ACORN that verifies that a cassette program has loaded into memory correctly. The program itself fits into the upper 48 bytes of RAM in the INS8154 I/O chip (81). To use the routine one sets up the address 0ED0 on the ACORN, starts the tape and presses the GO key. After a few seconds a message will appear (either ERROR or FINE) and the program will return you to the monitor.

```
Address Op-code Label    Mnemonic    Comments
0ED0    A204    VERIFY   LDX#4       LOAD COUNTER
0ED2    20DDFE  LOADOR   JSR GETBYTE  FIND ADDRESS
0ED5    9505             STA2,X-95   STORE IN FAP AND TAP
0ED7    CA               DEX         DECREMENT COUNTER
0ED8    D0F8             BNE LOADOR  X ZERO ON EXIT
0EDA    20DDFE  COMPROG  JSR GETBYTE  GET BYTE FROM TAPE
0EDD    C105             CMP (D5,X)  COMPARE WITH MEMORY
0EDF    D007             BNE ERROR   ERROR?
0EE1    20A0FE           JSR COM16   NO, INCREMENT ADDRESS
0EE4    D0F3             BNE COMPROG KEEP ON GOING
0EE6    A005             LDY#05      ALL OK SO Y=5
0EE8    A204    ERROR    LDX#04      ERROR SO Y REMAINS 0
0EEA    B9FA0E  MESSAGE  LDA4,YDATA1 READ MESSAGE FROM DATA
0EED    9510             STA1,XD     AND PUT ON DISPLAY
0EEF    88               DEY         DECREMENT DATA INDEX
0EF0    CA               DEX         AND SCREEN POSITION
0EF1    10F7             BPL MESSAGE CONTINUE WITH MESSAGE
0EF3    4C04FF           JMP RESTART RETURN TO MONITOR
0EF6    795D5D  DATA     'E'+'R'*'R'
0EF9    5C50             'O'+'R'     'ERROR'
0EFB    007104  DATA1    ' '+'F'*'I'
0EFE    5479             'N'+'E'     'FINE'
```

I'm afraid that I don't have access to an ACORN but it does look like a rather well designed machine. I'd be interested to hear from anyone who has written other programs for it.

Expression Input

Last September I asked for suggestions for getting an equation into a running BASIC program. The only general solution that emerged was that the file should be saved with the equation in it and then that the new file should be CHAINED in. Even using this technique there are several variations, like these: Chris Wilkinson of Eastbourne suggests the following:

```
10 PRINT "INPUT YOUR EXPRESSION"
20 INPUT E$
30 PUT "PROGB",*10*;E$
40 PUT "PROGB",*20 CHAIN PROGA,100*
50 CLOSE *PROGB*
60 CHAIN *PROGB*
100 REM CONTINUE PROGA
```

J. J. Marten of Chelmsford suggested the following variation, in PDP-11 BASIC:

```
10 PRINT "INPUT YOUR EXPRESSION"
20 INPUT E$
30 OPEN "FUNCT" FOR OUTPUT AS FILE #1
40 PRINT #1:"100 DEF FNY(X)=";E$
50 CLOSE #1
60 OVERLAY "FUNCT"
100 REM CONTINUE PROGAM WITH NEW LINE 100
```

Joshua Danziger of Whitfield, Manchester suggests the following for a SYSTIME 3000 running RSTS 11;

```
1000 ON ERROR GOTO 2000
1010 OPEN "GRAPH2.BAS" FOR INPUT AS FILE 1%
1020 OPEN "TEMP.FIL" FOR OUTPUT AS FILE 2%
1030 INPUT "EXPRESSION IN TERMS OF X";E$
1040 E$="1000"+E$
1050 &#25,E$
1060 INPUT LINE #1%,L$
1070 &#25,L$
1080 CLOSE 1%,2%
1090 KILL "GRAPH2.BAS"
1100 NAME "TEMP.FIL" AS "GRAPH2.BAS"
1110 CHAIN "GRAPH2.BAS"
2000 IF ERL=1060 THEN RESUME 1060 ELSE ON ERROR GOTO
```

It certainly is hard work isn't it!

Jobs

I've had about 25 replies from people looking for jobs and have managed to place a few of those, I am glad to say. I will keep my eyes open for other companies looking for young people and will continue to pass on details to companies. Please don't ask me to send "full details of the jobs available" because most of the jobs go almost immediately and anyway the companies concerned often make the job match the person rather than the other way round—which is rather nice.

380Z programs

I am on the scrounge for some really good programs for the R. M. 380Z — both games with good graphics and "useful" programs — again using graphics wherever possible. I would like to receive these on cassette or disc so as an inducement I will send a free copy of the next month's PCW to anyone who sends in a cassette program (I keep the cassette!) or I will send a free copy of PCW and return your disc. In a few months time this page should be packed with 380Z programs (remember how long it takes to get things into print). I'll tell you later why I am on the scrounge.

Help

As usual please send stuff in that you would like to see published. It can be a program, an electronic design or your suggestions and comments on some equipment, service or software. My address is Laxton House, Oundle, Peterborough. Thanks.

PETs and tanks

Lastly, Kevin Jones (13) of Lytham St Annes has, with the aid of his father, produced a Tank Battle simulation for the PET. He tells me that it will work in a 4K PET if all the REMs are removed and it will work in both new and old ROM PETS. The game takes place across a minefield, with the additional hazard of walls to negotiate. The game is for two players, each equipped with a tank, and the first to score ten points wins. A point is scored by hitting your opponent's tank with a missile. Each player has 9 controls arranged in a 3 by 3 square. Though the game was written for a PET it should be fairly easy to adapt. The PET's instruction POKE 32768+40*Y+X,Z is equivalent to PLOT X,Y,Z on other machines.

The listing is in the "Programs" section.

DIRECT ACCESS

IN STORE

Britain's most up-to-date and comprehensive guide to the selection of microcomputer equipment, compiled for PCW by Richard Olney of Heuristic Consultants.

Machine (Price from)	Main Distributor/s (No. of dealers)	Hardware	Software	Documentation	Miscellaneous
ABC 80 (£790)	CCS Microsales: 01-444 7739 (TBA)	16-40K RAM: Z80A: C: 12", 16x40 b&w VDU: 4680 bus: IEEE 488: RS232 port: option — dual 5¼" F/D (160K, own DOS), £895	DOS: BASIC: games: *W/P: Database: Engineering & construction prog*	S	Graphics loudspeaker with 128 effects: Viewdata compatible.
ALPHA MICRO (£5,700)	Alpha Micro Systems UK Ltd: 01-930 1991 (TBA)	64K-16M RAM: W/L 16 bits: Dual 8" F/D (1.2MB): 6 S/P: modular	multi-user O/S: BASIC: M/A: PASCAL: T/E: *U: B/P*	E	Expands to 1200 MB, 32 terminal system: average 10MB H/D system — £1,100
APPLE II (£810)	Microsense: 0442 63561 (80+)	16-48K RAM: 6502: 8 I/O slots: 15"x18"x5": options — single 5¼" F/D (116K), £425; *C*, £33; RS232 int, £110; 16K RAM, £110	O/S: BASIC: *PASCAL: games*	S	280x192 high resolution graphics: integer BASIC in 6K ROM
ALTOS ACS 8000 (£3,398)	Logitek: 02572 66803 (TBA)	64K RAM: Z80: 1K ROM: dual 8" F/D (1MB): 2 RS232: 1 P/P	CP/M: *BASIC: FORTRAN: COBOL: PASCAL: M/A: W/P: B/P*	S&H	Extensive software support by Interface Software Ltd., of Camberley.
ATTACHE (£7,000)	R. H. Thorpe Ltd: 0276 29492. R. J. Spiers Ltd: 0603 416573 (TBA)	48K RAM: 8080: dual 8" F/D (616K): 9", 16x64 b&w VDU: 180 cps printer	ExBASIC: B/P: *FORTRAN*	S	W/P package available soon
BILLINGS BC-12FD (£4,295)	Mitech: 04862 23131 (TBA)	64K RAM: Z80A: dual 5" F/D (640K): 12", 24x80 b&w VDU: options — 80 col 160 cps printer, £375: 132 col 55cps DM printer, £975	DOS: BASIC: *FORTRAN: COBOL: A.*	S	Also avail, BC-DF2M with dual 8" F/D (2MB) instead of 5", £6,000; extra dial 8" F/D, £2,750; with 50MB H/D from £11,000; Graphics.
CBS Mk I (£4,900)	Compelec: 01-636 1392 (n/a)	64K RAM: Z80: dual 8" F/D (1MB): 12", 24x80 VDU: 132 col, 30 cps printer: 2 S/P: 1 P/P: options — 150cps bi-directional printer, £2,000: 55cps W/P printer, £2,000	CP/M: BASIC: *W/P: U: B/P*	S&H	Mk II available with 2MB F/D, £5,900. Can upgrade to Mk III. Desk mounted.
CBS Mk III (£8,150)	As above	64K RAM: Z80: dual 8" F/D (1MB): 12", 24x80 VDU: 132 col, 30cps printer: 11MB H/D: 8 S/P: 1 P/P: options — 150cps bi-directional printer, £2,000: 55cps W/P pointer, £2,000 12". 24x80 VDU, £655.	CP/M: BASIC: *W/P: U: B/P*	S&H	Up to 44MB H/D possible, £4,500 extra. Multi-user system with 280K RAM, £10,150.
CHALLENGER — 1P (£238)	Mutek: 0225 743289 1414. CTS: 0706 79332 U-Microcomputers: 0606 853390 Microcomputer Business Machines: 01-980 3993 Byte Shop: 01-518 Millbank Computing 01-549 7262	4-32K RAM: 6502: C int: RS232 port: 15"x16"x4": option — dual 5¼" F/D (160K), £550	O/S: BASIC: A: games: *ExBASIC: Data Man: B/P (limited).*	S	D/A conv: colour capability: 8K microsoft BASIC in ROM
CHALLENGER C2 (£404)	As above	4-48K RAM: 6502: C int: RS232 port: 15"x16"x4": options — dual 5¼" F/D (160K), £550; dual 8" F/D (1.15MB); 20MB H/D.	O/S: BASIC: A: games: *ExBASIC: Data Man: B/P (limited)*	S	Can run OSI business software if 8" F/D inc.

List of Abbreviations

A Assembler
B BASIC
B/P Business package
C Cassette
C/P Commercial package
E Extensive
F/D Floppy disc
G/C Graphics card
H Hardware
H/D Hard disc
I Introductory
int Interface
I/S Indexed sequential
K/B Keyboard
M/A Macro assembler
N/P Numeric pad
O/S Operating system
P/P Parallel port
S Software
S/P Serial port
TBA To be announced
T/E Text editor
T/P Text processor
U Utility
W/L Word length
W/P Word processor

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT

Machine (Price from)	Main Distributor/s (No. of dealers)	Hardware	Software	Documentation	Miscellaneous
CHALLENGER C3 (£2334)	As above	32-56K RAM: 6502, 6800, Z80: dual 8" F/D (1.15MB): 2-16 S/P: 17"x22"x12"	OS65U: BASIC: *CP/M FORTRAN COBOL: B/P: W/P: Data Management*	S&H	Also C3B & C3P H/D modules: 74MB for about £10,000
COMMA VO3 (£4,200)	Comma: 0277 811131 (n/a)	32K RAM: LSI 11: dual 8" F/D (512K): 4 serial DLU11S ports: modular	*RT11 0/S (£750): BASIC: COBOL: FORTRAN: B/P (limited)*	H	Many configs possible: max 20 MB H/D — about £27,000
COMPELEC SERIES (£2,400)	Compelec: 01-636 1392 (n/a)	64K RAM: Z80: dual 8" F/D (512K): 2 RS232 ports, 1 P/P	CP/M: A: CBASIC: COBOL: FORTRAN: PASCAL: *W/P: B/P*	S	Also with double density F/D, 1MB, £2,900; 1K EPROM
COMPUCORP 625 (£6,000)	Compucorp: 01-952 7860 (15)	60K RAM: Z80: dual 5¼" F/D (700K): 9", 16x80 b&w VDU: 40cps printer 1 RS232 port: 20"x28"x10"	A: BASIC: U: *W/P: B/P*	B	Also available, 655 model with 315K F/D capability & 12", 20x80 VDU — £3,750
COMP WORKSHOP SYSTEM 1 (£1,600)	Comp Workshop: 01-491 7507 (n/a)	32K RAM: dual 5¼" F/D (170K): 9", 16x64 b&w VDU: modular	A: BASIC: FORTRAN: FLEX: PASCAL: PILOT: *B/P*	E	These systems are example configs from a fully compatible modular range
COMP WORKSHOP SYSTEM 2 (£11,000)	As above	128K RAM: 6809: dual 8" F/D (1.2MB): 3 intelligent 20x80 terminals; 80 col, 125cps printer: daisy wheel Sprint 3 printer	A: BASIC: FORTRAN: FLEX: PASCAL; PILOT: *B/P*	E	As above
COMP WORKSHOP SYSTEM 3 (£36,000)	As above	768K RAM: 6809: dual 8" F/D (1.2MB): 64MB H/D: 10 intelligent 20x80 terminals: 2 132 col, 120cps printers: 2 80 col, 125cps printers: 2 daisy wheel Sprint 3 printers: max 16 ports.	A: BASIC: FORTRAN: FLEX: PASCAL: PILOT: *B/P*	E	As above
COMPUCOLOUR II (£1,058)	Abacus: 01-580 8841 (6)	8-32K RAM: 8089: 13", 32x64 8-colour VDU: single 5¼" F/D (51K): RS232 port: 18"x15"x13"	ExBASIC (ROM): *A: personal data base: games*	I	16K module, £1,134; 34K, £1,137; maintenance & programming manual available.
CROMEMCO SYSTEM 2 (£1,995)	Comart: 0480-215005. Datron: 0742-585490. Microcentre: 031-225 2022 (20)	64K RAM: Z80: dual 5¼" F/D (180K): options — dual 8" F/D (512K), £1370; 11MB H/D, £3495; 22MB H/D, £5999	CDOS: *BASIC: COBOL: FORTRAN (£55): multi-user BASIC*	E	Expandable to multi-user system (2-7 users), £3,455-£6,400
CROMEMCO SYSTEM 3 (£2,995) (64K, £3,293	As above	32-64K RAM: Z80: dual 8" F/D (512K): options as above: extra dual F/D, £1,200	CDOS: *BASIC: COBOL: FORTRAN; multi-user BASIC*	E	As above
DIGITAL MICROSYSTEM DSC-2 (£5,395)	Modata: 0892 39591 (TBA)	64K RAM: Z80: dual 8" F/D (2.28MB): 4 RS232 ports: EIA port: 17"x21"x7"	CP/M: BASIC-E: *CBASIC: COBOL: FORTRAN: PASCAL: CAP B/P*	H	Up to 6 additional F/D units possible
DURANGO (£7,750)	Comp Ancillaries: 07843 6455 (12)	48K RAM: 8085x3: dual 5¼" F/D (1MB): 9", 16x64 green VDU: 132 col 165cps printer: N/P: options — add F/D £1,753; aux VDU £875	O/S: *DBASIC: B/P*	S	Takes up to 4 workstations: fully integrated system 15"x30"x24"
DYNABYTE DB8/1 (£1,500)	Dynabyte UK/Europe Ltd: 0723 65559 (6)	32-64K RAM: Z80: S100 bus; 2 RS232 ports: 1 P/P: 20"x18"x7": option — dual 8" F/D (1MB), £2,000	CP/M: *BASIC: COBOL: FORTRAN: PASCAL: W/P: B/P*	H	Expands to multi-user system: also DB8/2 with dual 5¼" F/D (400K), £3,000
EG 3003 (£378)	Lowe Electronics:0629 2817 (TBA)	16K RAM: Z80: 500 bps C: 32x64 TV int: extra C int: 1 P/P: K/B	BASIC: *M/A: FORTRAN: B/P*	I	BASIC in 12K ROM; Graphics available; F/D system under development.
EQUINOX 200 (£9,995)	Equinox: 01-739 2387 (n/a)	64-256K RAM: Z80: 10MB H/D: 15", 24x80 b&w VDU: 15cps printer	CP/M: BASIC: COBOL: FORTRAN: MVT/FAMOS	S&H	
EQUINOX 300 (£11,750)	As above	64-256K RAM: W/L 16 bits: 10MB H/D: 15", 24x80 b&w VDU: 150cps printer: 6 S/P	O/S: BASIC: COBOL: M/A: PASCAL: *LISP: SNOBOL: T/P multi-user:*	S	Up to 1200MB of storage possible (4x300MB, Calcomp Tridents)

DIRECT ACCESS

IN STORE

Machine (Price from)	Main Distributor/s (No. of dealers)	Hardware	Software	Documentation	Miscellaneous
EUROC (£7,995)	Eurocalc Ltd: 01-405 3113 (TBA)	64K RAM: 8080A: dual 8" F/D (1MB): 15", 25x80 b&w VDU: 132 col, 140cps printer	CP/M: CBASIC: S A: account system: U: *B/P*		A year's maintenance and stationary supply inc.
EXIDY SORCERER (£650) (16K, £760; 32K £859)	Liveport Data Products Ltd: 073 670 6320 (27)	8-32K RAM: Z80: RS232: 1 P/P: $100 connector: 30x64 VDU I/O: options — dual 5¼" F/D (630K), £1,200; 12", 30x64 green VDU, £240; S100 chassis, £210	O/S: ExBASIC (ROM): *W/P: Editor: A: games*	I	High resolution graphics capability.
H11 Kit (£1,844)	Heath: 0452 29451 (n/a)	LSI 11: 16-32K RAM: 24x80 VDU int: up to 16 S/P or P/P: options — dual 8" F/D (512K), £1,325: 12", 24x80 VDU, £558	*O/S: BASIC: FORTRAN: A: games: T/E: U.*	S&H	CPU and VDU int boards sold as separate items.
HEATH WH89 (£1,380)	As above	16-48K RAM: Z80: single 5¼" F/D (102K): 12", 25x80 b&g VDU: RS232: 13"x17"x20": options — 16K RAM, £158	*BASIC: A: W/P: B/P*	I	Cassette available instead of F/D, £882; in kit form WH89 is £1,200
IMS 5000 (£1,935)	Equinox: 01-739 2387 (20)	32-64K RAM: Z80: dual 5¼" F/D (320K)	CP/M: BASIC: COBOL: FORTRAN: *PASCAL: W/P*	S&H	3 drives option
IMS 8000 (£3,515)	As above	64-256K RAM: Z80: dual 8" F/D (1MB)	CP/M: BASIC: COBOL: FORTRAN: *PASCAL: W/P: CAP: Micro COBOL: MVT/ FAMOS: multi-user*	S&H	4 drives optional
IMSAI VDP 42 (£3,900)	Computermart: 0603 615089. Corner Comp: 03727 41101 (2)	32-64K RAM: 8085: dual 5¼" F/D (400K): 9", 24x80 b&w VDU: 1 S/P: 1 P/P: 18"x27"x12"	IMDOS (CP/M comp): A: ExBASIC: U: *CBASIC: COBOL: FORTRAN*	H	Can support 8 additional F/D drives; also available, VDP 44 with F/D (780K), £4,400
IMSAI VDP 80 (£6,200)	As above	32-64K RAM: 8085: dual 8" F/D (1.2MB): 12", 24x80 b&w VDU: 1 S/P: 1 P/P: 25"x15"x25"	IMDOS: A: ExBASIC: U: *CBASIC: COBOL: FORTRAN: CAP B/P*	H	
ITT 2020 (£867) (32K, £931 48K, £995)	ITT: 0268 3040 (15)	16-48K RAM: 2020: 15"x 18"x4": options — single 5¼" F/D (116K), £425, C, £33; 60cps printer, £825; 16K RAM, £110; RS232 port, £96	Monitor: A: ExBASIC: Dis-A: *games*	B	360x192 high resolution graphics: ExBASIC in 6K ROM.
LX-500 (£3,500)	Logabax Ltd: 01-965 0061 (13)	32K RAM: Z80: dual 5¼" F/D (180K): 12", 25x80 b&w VDU: 100bps printer: option — 80 col 60cps printer, £500	DOS: BASIC: A	S	Other printers available.
MEGAMICRO (£6,080)	Bytronics: 0252 726814 (5)	256K: 8080A: dual 8" F/D (1MB): 12", 20x80 b&w VDU: 120cps printer: 2 S/P: 2 P/P: option — printer stand, £100	CP/M: U: *B/P*	H&B	
MICROENGINE (£2,080)	Pronto: 01-599 3041 (TBA)	64K RAM: MCP 1600: 2 RS232 ports: 2 P/P: 16"x13"x5": options — dual 5¼" F/D (1MB), £1,500; dual 8" F/D (2MB), £1,200	BASIC: PASCAL: File Manager: U	H&S	CPU has user written word set: PASCAL uses integral P code: available as board, £1,400

List of Abbreviations

A Assembler
B BASIC
B/P Business package
C Cassette
C/P Commercial package
F Extensive
F/D Floppy disc
G/C Graphics card
H Hardware
H/D Hard disc
I Introductory
int Interface
I/S Indexed sequential
K/B Keyboard
M/A Macro assembler
N/P Numeric pad
O/S Operating system
P/P Parallel port
S Software
S/P Serial port
TBA To be announced
T/E Text editor
T/P Text processor
U Utility
W/L Word length
W/P Word processor

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT

Machine (Price from)	Main Distributor/s (No. of dealers)	Hardware	Software	Documentation	Miscellaneous
MICRO-NOVA (£12,000)	Digitus: 01-636 0101 (3)	64-1128K RAM: N601: 10MB H/D (5 fix, 5 rem): 12", 24x80 VDU: 132 col 60cps printer: 4 S/P: 1 P/P	DOS: M/A: U: T/E: I/S: debug: FORTRAN IV: *BASIC: PASCAL: WP: B/P*	E	Larger configs usual: bus system for multi-user; smaller system possible with F/D
MICRO-STAR 45 PLUS (£4,950)	Data Efficiency: 0442 57137 (TBA)	64K RAM: 8085: dual 8" F/D (1.2MB): 3 S/P: RS232 port: 17"x26"x8"	STARDOS: CP/M: BASIC: COBOL: FORTRAN: UPDATE (database): *B/P*	E	
MSI 6800 (£1,203)	Strumech: 05433 4321 (5)	16K RAM: 6800: C: (9", 16x64 b&w VDU: 1 S/P: option — PROM prog	BASIC: mini A T/E: U	H&S	Up to 8 serial or parallel interfaces possible.
MSI 6800 SYSTEM 1 (£2,175)	As above	32K RAM: 6800: dual 5¼" F/D (160K): 9", 16x24 b&w VDU: 1 RS232 port: option — dual 8" F/D (624K), £1,640	DOS, BASIC: U: *A: FORTRAN: T/E*	H&S	As above
MSI 6800 SYSTEM 2 (£7,500)	As above	56K RAM: 6800: Single 8" F/D (312K): 10MB H/D: 1 RS232 port: 9", 16x64 b&w VDU: options — dual 8" FYD (624K), £1,640 10MB H/D £4,250	DOS: BASIC: multi-user BASIC: A: *B/P*	H&S	Rack mounted
NORTH STAR HORIZON (£4,650 for 48K)	Comart: 0480 215005. Comma: 0277 811131. Equinox: 01-739 2387 (20)	24-56K RAM: Z80A: dual 5¼" F/D (360K): 15", 24x80 b&w VDU: 150cps printer: 2 S/P: 1 P/P	DOS: BASIC: *CP/M: COBOL: FORTRAN: PASCAL: B/P*	E	
PET 2001-8 (£550)	Commodore: 01-388 5702 (150)	8K RAM: 6502: C: 9", 25x40 VDU: IEEE488 (non standard) port: options — dual 5¼" F/D (353K), £795; 80 col 93cps printer, £645; expand to 32K RAM, £249	O/S: BASIC: A: *FORTH: PILOT: games*	I	Graphics facility: BASIC in 8K ROM: also available, dual 5¼" F/D (800K), £995 + £30 for operating ROM
PET 2001 - 16/32 (£675) (32K, £795)	As above	16-32K RAM: 6502: C: 9", 25x40 green VDU: IEEE488 (non standard) port: options — dual 5¼" F/D (353K), £795; 80 col 93cps printer, £645	O/S: BASIC: A: *FORTH: PILOT: games*	I	As above but disc operating ROM included.
POWER-HOUSE 2 (£1,200)	Powerhouse Micros: 0442 48422 (TBA)	32K RAM: Z80A: 5", 27x96 b&w VDU: 1 S/P: 1 P/P: 17"x11"x7": options — IEEE488 int, £110; C, £170; G/C, £190	FDOS: BOS: BASIC: *games: C/P: ExBASIC (14K EPROM), £260*	I	
RAIR BLACK BOX (£2,300)	Rair: 01-836 4663 (n/a)	32-64K RAM: 8085: dual 5¼" F/D (160K): 2 RS232 port: 20"x16"x 5": option — dual 5¼" F/D (520K), £1,000	CP/M: BASIC: COBOL: FORTRAN: M/A: T/E: *B/P*	H	16K RAM expansion, £250.
RESEARCH MACHINES 380 - Z (£1,048) (56K, £1,654)	Research Machines: 0865 49791 (n/a)	16-56K RAM: Z80A: C: RS232 port: 19"x16"x6": options — dual 5¼" F/D (168K), £895; dual 8" F/D (1MB), £1,695 (fitted in machine)	Tiny BASIC: games: graphics: *A: ExBASIC: CBASIC: COBOL: FORTRAN: ALGOL: CP/M: U*	S	Designed for education: high resolution graphics being developed
SDS 100 (£4,290)	Airamco: 0294 57755 (11)	64K RAM: Z80: dual 8" F/D (1MB): 12", 24x80 VDU: S100 bus: RS232 port: N/P: 1 P/P	CP/M: A: ExBASIC: *COBOL: FORTRAN: CAP B/P*	E	Facility for 8K PROM
SEMEL 1 (£2,900)	Strutt Electrical: 0822 5439 (n/a)	16-64K RAM: Z80: single 8" F/D (250K): 12", 24x80 b&w VDU: RS232 port: options — single 8" F/D (250K), £500; light pen	BASIC: *COBOL: FORTRAN: B/P*	I	Supports up to 8 drives
SHARP MZ-80K (£520-£740)	Sharp UK: 01-571 2157 2157 (22)	6-34K RAM; Z80: C: 10", 24x40 b&w VDU	BASIC: A: *games*	B	Graphics: loudspeaker: BASIC in 14K RAM

DIRECT ACCESS

IN STORE

Machine (Price from)	Main Distributor/s (No. of dealers)	Hardware	Software	Documentation	Miscellaneous
SIMPELEC Mk I (£6,900)	Compelec: 01-636 1392 (n/a)	64K RAM: Z80: dual 8" F/D (1MB): 12", 24x80 VDU: 55cps daisywheel printer: 2 S/P: 1 P/P: options — 150cps bi-directional printer, £2,000; 55cps W/P printer, £2,000	CP/M: BASIC: W/P	S&H	Also available, Mk II with 2MB F/D, £7,900. Can upgrade to MkIII. Portable
SIMPELEC Mk III (£10,150)	As above	64K RAM: Z80: dual 8" F/D (1MB): 11MB H/D: 12", 24x80 VDU: 55cps daisywheel printer: 6 S/P: 1 P/P: options — 150cps bi-directional printer, £2,000; 55cps W/P printer, £2,000; W/P VDU, £900	CP/M: BASIC: W/P	S&H	Up to 44MB H/D possible, £4,500 extra. Multi-user system with 208K RAM, £12,150.
SIROCCO (£3,900)	Elvingate Computers: 069 24 5189 (TBA)	64K RAM: Z80: dual 5¼" F/D (740K): 12", 24x80 VDU: RS232 port: 19"x 14"x13": options — up to 3 ports; 10MB H/D, £4,000	CP/M: CBASIC: *COBOL: MBASIC: FORTRAN: PASCAL: LISP*	S	Direct memory addressing. Memory mapped VDU. Free standing keyboard.
SMOKE SIGNAL CHIEFTAIN 1 (£3,050)	Windrush Micro Designs: 069-24 5189 (TBA)	32-64K RAM: 6800: dual 5¼" F/D (160K): 12", 24x80 VDU: 112cps printer: RS232C port: option — 16K RAM expansion, £500	DOS: BASIC: *DBASIC: RBASIC: A: FORTRAN: U: T/E: B/P*	E	Also available, Chieftain 3 with dual 8" F/D (1MB), £3,950.
SOLITAIRE/ WP (£6,750)	Solitaire/KPG: 04252 71448 (TBA)	64K RAM: 8085: dual 5¼" F/D (700K): 14" VDU (with own CPU): 45cps printer: CPU	DOS: W/P: *BASIC*	S	All Solitaire systems are compatible: graphics on 11x13 dot matrix
SOLITAIRE/ BS200 (£7,950)	As above	64K RAM: 8085: dual 8" F/D (960K): 14" VDU (with own CPU): 45cps printer: CPU port	DOS: BASIC: W/P: *specialised B/P*	S	As above
SOLITAIRE/ HBS100 (£9,500)	As above	64K RAM: 8085: 10MB Fix H/D: 14" VDU (with own CPU): 200cps printer: CPU port: option — up to 40MB H/D	DOS: BASIC: W/P: *specialised B/P*	S	Up to 8 interface terminals can be used: also available, HBS200 with 20-80MB H/D.
SORD M100 ACE (£2,650)	Midas Computer Services Ltd 0903 814523	48K RAM: Z80: single 5¼" F/D (143K): 12", 24x64 colour VDU: RS232 port: option — single 5¼" F/D, £300	O/S: BASIC	I	With colour graphics: 8K ROM
SORD M223 (£3,500)	As above	64K RAM: Z80: single 5¼" F/D (350K): 12", 24x80 b&w VDU: S100 bus: RS232 port: option — extra F/D, £450	O/S: BASIC: *CAP B/P*	I	Other configs possible.
SUPER-BRAIN (£1,995)	Icarus: 0632 29593 (TBA)	64K RAM: 2xZ80: dual 5¼" F/D (320K): 12", 25x80 b&w VDU: S100 bus: RS232: TRS80 port: 21"x23" x14": options — dual 5¼" F/D (320K); dual 8" F/D (2.4MB); 8-120MB H/D	CP/M: A: *BASIC: COBOL: FORTRAN: APL: B/P*	H&S	Limited graphics: mainframe interface available
TANDBERG EC10 (£5,000)	Tandberg: 0532 35111 (n/a)	50K RAM: 8080A: single 8" F/D (250K): 12", 25x80 b&w VDU: RS232 port	ExBASIC (24K): multi-user BASIC: A: U: *COBOL*	H&S	Pascal available next year
TANDY TRS 80 LEVEL 1 (£380)	Tandy: 021 556 6101 (200)	4-16K RAM: Z80: C: 12", 16x64 b&w VDU	BASIC: games: A	I	BASIC in 4K ROM: upgradable to level 2
TANDY TRS 80 LEVEL 2 (£515-£1,005)	As above	4-48K RAM: Z80: C: 12", 16x64 b&w VDU: RS232 int: 1 P/P: option — single 5¼" F/D (78K), £478 (max of 4)	BASIC: games: I *M/A: FORTRAN: B/P*	I	16K machines include N/P: 4-16K upgrade, £120; without pad, £85

List of Abbreviations

A Assembler
B BASIC
B/P Business package
C Cassette
C/P Commercial package
E Extensive
F/D Floppy disc
G/C Graphics card
H Hardware
H/D Hard disc
I Introductory
int Interface
I/S Indexed sequential
K/B Keyboard
M/A Macro assembler
N/P Numeric pad
O/S Operating system
P/P Parallel port
S Software
S/P Serial port
TBA To be announced
T/E Text editor
T/P Text processor
U Utility
W/L Word length
W/P Word processor

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT

IN STORE

DIRECT ACCESS

Machine (Price from)	Main Distributor/s (No. of dealers)	Hardware	Software	Documentation	Miscellaneous
TECS (£1,600)	Technalogics: 051 724 2695 (TBA)	16-56K RAM: 6800: 8K PROM: RS232 port: C int: option — dual 5¼" F/D (320K), £800	BASIC	H	256 char graphics: Prestel compatible: plugs into standard TV
TEI 208 (£4,400)	Abacus: 01-580 8841 (5)	32-60K RAM: 8080/8085: dual 5¼" F/D 320K: 9'' 24x80 green VDU: 3 S/P: 3 P/P: 17''x18''10'': option — 150cps printer, £1,250	CP/M: *BASIC: COBOL: FORTRAN: PASCAL: ALGOL: B/P*	H&S	
TEI 212 (£5,067)	As above	32-60K RAM: 8080/8085: dual 8'' F/D (1MB): 15'', 24x80 green VDU: 3 S/P: 3 P/P: 17''x20''x17'': option — 150cps printer, £1,250	CP/M: *BASIC: COBOL: FORTRAN: PASCAL: ALGOL: B/P*	H&S	
TERODEC DPS 64/1-4 (£3,014)	Terodec (Microsystems) Ltd: 0344 51160 (TBA)	64K RAM: Z80: dual 8'' F/D (1MB): 12'', 24x80 b&w VDU: 2S/P 3P/P: options — dual 8'' F/D (1MB), £1,150; dual 8'' F/D (2MB), £1,455	CP/M: *BASIC: CBASIC: COBOL: FORTRAN: ALGOL: PASCAL: W/P: B/P: DATABASE*	H&S	TMZ 80 enhanced model in integral workstation £5,495, (with 4MB F/D); DPS 64 with 2MB F/D is £3,319
VECTOR GRAPHICS MZ (£2,300)	Almarc: 0602 248565 Sintrom Microshop 0734 84322 (5) Microtech: 0895 57780 (5)	48K RAM: Z80: dual 5¼" F/D (630K): 1 S/P: 2 P/P: 20''x17''x8''	DOS: BASIC: A: *CP/M: CBASIC: COBOL: FORTRAN: PASCAL:*	E	4K PROM
VECTOR GRAPHICS SYSTEM B (£2,850)	As above	48K RAM: Z80: dual 5¼" F/D (630K): 12'', 24x80 b&w VDU: 1 S/P: 2 P/P: 20''x17''x8''	DOS: BASIC A: *CP/M: CBASIC: COBOL: FORTRAN: PASCAL*	E	With graphics and N/P
ZENTEC (£5,700)	Zigal Dynamics: 0753 71049 (1)	32-64K RAM: 2x8080: dual 5¼'' F/D (280K): 15'', 25x80 b&w VDU: RS232 port: options — dual 5¼'' F/D (280K, £600: dual 8'' F/D (1MB), £2,100 RS422 port, £105	O/S: A: U: *BASIC: micro COBOL: W/P*	S	User programmable character set
ZILOG MCZ1/05 (£4,200 - portable)	Micropower: 0256 54121. Memec: 084421 5471 (n/a)	64K RAM: Z80: dual 8'' F/D (600K): RS232 port	Rio O/S: M/A: U: T/E: *BASIC: COBOL: FORTRAN: PASCAL: B/P*	H&S	Debug in 3K PROM: also available as desk top unit or R/M model, both £4,800.
ZILOG MCZ1/35 (£1,200)	As above	64K RAM: Z80: 10MB H/D (5 fix, 5 rem): RS232 port	Rio O/S: M/A: U: T/E: *BASIC: COBOL: FORTRAN: PASCAL: B/P*	H&S	Internal disc control with own Z80
Z-PLUS (£4,000)	Rostronics: 01-874 3665 (TBA)	32-64K RAM: Z80: dual 8'' F/D (1MB): 2 S/P: 2 P/P: 10''x29''x11''	CP/M: A: U: *BASIC: COBOL: FORTRAN: PASCAL: Database: B/P*	H&S	

SINGLE BOARDS

ACORN (£65)	Acorn: 0223 312772 Microdigital: 051227 2535. Newbear: 0635 30505 (n/a)	1.1/8K RAM: 6502: EPROM socket: Hex K/B: C int: 8 digit LED display: up to 16 ports: options — Eurocard 64 way connector: VDU card: Full K/B card.	½K monitor: *Basic*	S&H	Kit: programmable address linking; on board 5V regulator: available assembled, £79.
AIM 65C (£265)	Pelco: 0273 722155 (4)	1-4K RAM: 6502: 12K ROM: full K/B: 20 char LED display: 20 char thermal printer: Cx2: RS232 port.	A: Dis A: T/E: 8K monitor in ROM	E	Available as S100 system with A or BASIC in ROM (£480) from Portable Micros (0280 702017): they also have briefcase version (£750)
CROMEMCO SC (£260)	Comart: 0480 30505 (17)	1K RAM: Z80A: 8K EPROM sockets: RS232 port: 3 P/P: option — S100 bus.	*Monitor and control BASIC in EPROM*	E	5 program interval timers: can put own BASIC programs in EPROM.

IN STORE

Machine (Price from)	Main Distributor/s (No. of dealers)	Hardware	Software/ Firmware	Documentation	Miscellaneous
ELF II (£114)	Newtronics: 01-739 1582 (15)	1/4K RAM: RCA 1802: Hex K/B: 2 digit LED: TV int: C int: RS232 port: options — 4K RAM, £69; full K/B; VDU card	1K monitor: A: Dis A: T/E: *BASIC: games*	H	TTY, n-line decoders: low resolution graphics (high resolution available) kit.
EXPLORER (£295)	Newtronics: 01-739 1582 (15)	4K RAM: 8085: Hex K/B: RS232 port: S100 bus: C int: options — 6 slot S100, £32; 8K EPROM sockets, £50	2K monitor: *CP/M: BASIC*	S&H	Programmable 14 bit counter: kit
H8 (£262)	Heath: 0452 29451 (TBA)	4K RAM: 8080A: Octal K/B: 6 digit LED: speaker: options — single 5¼" F/D (102K), £399; 16K RAM, £314; C int, £72	1K monitor: *BASIC in RAM: FORTRAN: T/E: A: U: games.*	S&H	Kit
HEWART 6800S (£299)	Hewart: 0625 22030 (n/a)	16K RAM: 6800: full K/B: VDU int: 2xC int: 1 S/P: 2 P/P: option — 16K RAM, £90.	1K monitor: A: T/E	H	Can be upgraded with 6809.
HEWART 6800 Mk III (£152)	As above	1K RAM: 6800: VDU board: options — single 5¼" F/D (75K), £350; PROM programmer, £32: calculator board, £32	1K monitor	H	
Mk 14 (£39.95)	Science of Cambridge: 0223 311488 (n/a)	8060: 1/4-2K RAM: Hex K/B: 7 char LED: options — VDU int (32x16 with graphics), £29; C int, £6; PROM prog, £10, 2K memory expansion, £15	Machine code	H	Designed for control applications rather than high level computing expansion.
NASCOM 1 (£165)	Nascom: 02405 75155 (20)	4K RAM: Z80: full K/B: TV int: 2 P/P: 1 S/P	2K monitor: *BBASIC: tiny BASIC: A: T/E: U*	S&H	Now available as Nascom 2 with 8K RAM and 8K microsoft BASIC in ROM, £295
SBC 100 (£135)	Airamco: 0294 57755 (11)	1K RAM: Z80: 8K ROM: S100 bus: 1 S/P: 1 P/P: option — voltage regulator.	*1K monitor: DOS in ROM*	E	Kit: available assembled, £196
SUPER-BOARD (£188)	NBM: 01-981 3993 (n/a)	4-8K RAM: 6502: 10K ROM: full K/B: VDU int: C int: options — RS232; single 5¼" F/D (100K), £316; 8K RAM, £188	BASIC in 8K ROM: *games: B/P: Database*	S&H	Available with 32K RAM and single 5¼" F/D, £867
SYM-1 (£160)	Newbear: 0635 30505 (n/a)	1-4K RAM: 6502: Hex K/B: 244 bps C int: VDU int: 2x6522 ports: option — TV int.	4K monitor: *BASIC: A*	S&H	Can be expanded to 64K RAM
TRITON 4.1 (£286)	Transam: 01-402 8137 (n/a)	2K RAM: 8080: 3K ROM: full K/B: 16x64 VDU or TV int: C int: 1 S/P: option — 2K RAM, £30	1K monitor: 2K BASIC: U	S&H	64 character graphics: 8 levels interrupt: kit
TRITON 5.1 (£294)	As above	2K RAM: 8080: 4K ROM: full K/B: 16x64 VDU or TV int: C int: 1 S/P: C: options — 8K RAM, £97; 8K EPROM, £97	1K monitor: 2K ExBASIC: U	S&H	Kit:assembled version, £393
TRITON 6.1 (£399)	As above	2K RAM: 8080: 4K ROM: full K/B: 16x64 VDU or TV int: C int: 1 S/P: C: options — 8K RAM, £97; 8K EPROM, £97	2K monitor: 7K scientific BASIC in 8K EPROM or A: Dis A: U	S&H	Either firmware package available for extra £110: CP/M compatible disc interface available soon.
UK 101 (£219)	Computer Shop: 01-440 7033	4K RAM: 6502: full K/B: 16x48 VDU or TV int: C int: RS232 port: option — 4K RAM, £49	1K monitor: 8K BASIC: *Dis A: U*	S&H	Graphics: will run Superboard software.

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H Hardware
H/D Hard disc
I Introductory int Interface
I/S Indexed sequential
K/B Keyboard
M/A Macro assembler
N/P Numeric pad
O/S Operating system
P/P Parallel port
S Software
S/P Serial port
TBA To be announced
T/E Text editor
T/P Text processor
U Utility
W/L Word length
W/P Word processor

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT

DIARY DATA

DIRECT ACCESS

Wembley, England	Microsystems '80 Exhibition & Conference. Iliffe Promotions Ltd., Dorset House, Stamford St., London SE1 9LU. Tel: 01-261 8000.	Jan 30 - Feb 1
Leeds, England	BEX — Business Equipment Exhibition. Douglas Temple Studios Ltd., 104b Old Christchurch Rd., Bournemouth, Dorset. Tel: 0202 20533	Feb 6 - Feb 7
Solihull, England	Mini Computers, Word Processors & Copying Machines Exhibition. Groundrule Exhibition Company, 7 Market Street, Altrincham, Cheshire WA14 2QW. Tel: 061 928 2227	Feb 12 - Feb 13
London, England	Business Computing, Word Processing & Information Mgt., Exhibition & Conference. BED Exhibitions Ltd., Bridge House, Restmor Way, Wallington, Surrey. SM6 7BZ. Tel: 01-647 1001	Feb 12 - Feb 15
Wembley, England	IMEC — European Information Management Exhibition & Conference. Clapp & Poliak Europe Ltd., 232 Acton Lane, London W4 5DL. Tel: 01-995 4806	Feb 18 - Feb 21
Bournemouth, England	BEX — Business Equipment Exhibition. Douglas Temple Studios Ltd., 104b Old Christchurch Rd., Bournemouth, Dorset, Tel: 0202 20533	Feb 20 - Feb 21
Swansea, Wales	OFFEX — Office Equipment Exhibition. Phoenix Exhibitions Ltd., 1st Floor, Burrows Chambers, East Burrows Rd., Swansea. Tel: 0792 460364	Feb 20 - Feb 22
Birmingham, England	IEA — International Instruments, Electronics & Automation Exhibition. Industrial & Trade Fairs Ltd., Radcliffe House, Blenheim Court, Solihull, West Midlands, B91 2BD. Tel: 021 705 6707	Feb 25 - Feb 29
Milan, Italy	International Exhibition of Numerical Control, Automation & Industrial Robots. CEU S.p.A., Via Monte Rose 21, 21049 Milan	Mar 3 - Mar 7
Birmingham, England	Computermarket '80, Couchmead Ltd, 42 Great Windmill Street, London W1V 7PA. Tel: 01-437 4187	Mar 4 - Mar 6
London, England	Microforum Europe. Business Equipment Trade Association, 109 Kingsway, London WC2B 6PU. Tel: 01-405 6233	Mar 11 - Mar 13
Manchester, England	Computermarket. Couchmead Ltd., 42 Great Windmill Street, London W1V 7PA. Tel: 01-437 4187	Mar 11 - Mar 13
Sheffield, England	Business Efficiency & Office Equipment Exhibition. Gwen Shillaber Design, 81 Whiteladies Road, Clifton, Bristol, BS8 2NT. Tel: 0272 312850	Mar 11 - Mar 13
Glasgow, Scotland	Computermarket '80. Couchmead Ltd., 42 Great Windmill Street, London W1V 7PA. Telephone: 01-437 4187	Mar 18 - Mar 20
London, England	Computermarket '80. Couchmead Ltd., 42 Great Windmill Street, London W1V 7PA. Telephone: 01-437 4187	Mar 25 - Mar 27
London, England	Viewdata '80 Exhibition. Online Conferences Ltd., Cleveland Road, Uxbridge, UB8 2DD. Tel: 0895 39262	Mar 26 - Mar 28
Brighton, England	Computer Aided Design Conference & Exhibition. Iliffe Promotions Ltd., Dorset House, Stamford Street, London SE1 9LU. Tel: 01-261 8000	Mar 31 - Apr 2
London, England	Peripherals '80 Exhibition. Iliffe Promotions Ltd., Dorset House, Stamford Street, London SE1 9LU. Tel: 01-261 8000.	Apr 16 - Apr 17
London, England	All Electronic Show. All Electronic Show, 34-36 High Street, Saffron Walden, Essex. Tel: 0799 22612	Apr 29 - May 1
Liverpool, England	Mersey Micro Show. Online Conferences Ltd., Cleveland Road, Uxbridge UB8 2DD. Tel: 0895 39262	April 30 - May 2
Brussels, Belgium	Compec Europe Exhibition. Iliffe Promotions Ltd., Dorset House, Stamford Street, London SE1 9LU. Tel: 01-261 8000.	May 6 - May 8
Manchester,England	Business Efficiency & Office Equipment Exhibition, Gwen Shillaber Design, 81 Whiteladies Rd., Clifton, Bristol BS8 2NT. Tel: 0272 312850	May 13 - May 15
London, England	International Word Processing Exhibition and Conference. Business Equipment Trade Association, 109 Kingsway, London WC2B 6PU. Tel: 01-405 6233	May 20 - May 23

TRANSACTION FILE

DIRECT ACCESS

For Sale

Pet 2001-8K. . .complete with manuals, assembler, games, BASIC book and BASIC games book. Perfect condition, only use — £450 ono. Contact Peter Toogood, 41 Dukes Avenue, London N10 2PX (01-883 1560).

Norris Electronic Projector. . .almost new — £225. Phone Atherstone (Warks) 2560.

Nascom 1. . . B-Bug (2K) monitor, complete, fully socketed board and keyboard, UHF modulator, tested and operational. PSU not included — £160 ono. Phone Lee on 01-549 0279 (evenings/weekends).

All going cheap...Z-Plus Microcomputer/ Disc — Z80, 64K, 1M Byte with Elbit Terminal 1920-X — £3,000; IP125 Matrix Printer — £400; Nascom 1 — £150; Tektronix Scope 545 — £100. Owner going overseas — phone 01-543 1398.

Pet 2001-8K. . .limited home use, excellent condition, complete with 2nd cassette and many programs — £495 ono. Also P.E. VDU board, needs attention, hence only £10. KB756 ASCII Keyboard — £25. Phone Cardiff 562133.

Compukit UK101. . .fully working with all leads, 8K memory, original plus extra software, manual and additional articles — £300 ono. Can demonstrate in London at weekends. Phone 047335 687 (Ipswich).

TI-59. . .plus PC100B — £200 (will split). Phone Crawley 36173.

UK101. . .4K RAM, 8K BASIC in specially built case with cassette recorder, mains and TV leads. Programs on cassette tape — £300. Contact J. G. Walton, 7 Hallfield Road, Newton, Derbys (Ripley 873244).

SWTPC 68000 Disc System. . .16K RAM, dual 5in floppy, FLEX operating system, editor, assembler, BASIC, many extras. Fully working. I am happy to arrange a demonstration anywhere — £850 ono. Phone 01-994 2360 any evening.

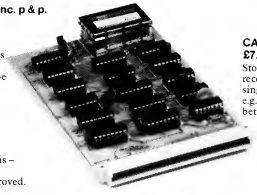
Challenger 1P. . .8K RAM, UK Power Supply, UHF modulator, 8K Microsoft BASIC, plus supplied and extra software. As new — £300. Phone Ruislip 72852 (after 6.30pm).

Nascom 1. . .complete and working in Verocase. Fully documented, inc £30 worth of books — £226. Phone Lancaster (0524) 67105.

Apple II 48K. . .great value! 3 months old and still under guarantee. It includes parallel printer interface card Applesoft

Now, the complete MK 14 micro-computer system from Science of Cambridge

VDU MODULE. £33.75
(£26.85 without character generator) inc. p & p.
Display up to ½K memory (32 lines x 16 chars, with character generator, or 4096 spot positions in graphics mode) on UHF domestic TV. Eurocard-sized module includes UHF modulator, runs on single 5 V supply. Complete ascii upper-case character set can be mixed with graphics.



CASSETTE INTERFACE MODULE. £7.25, inc. p & p.
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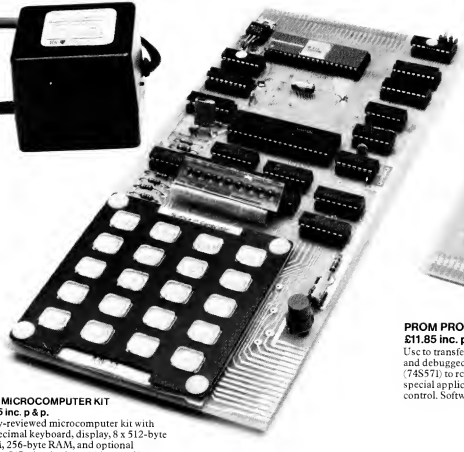

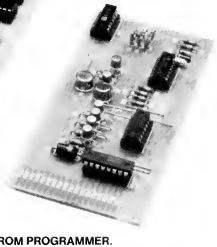

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- ☐ Power supply @ £6.10.
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TRANSACTION FILE

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Nascom 1. . . no need to slave with a soldering iron, this is ready built by a professional for use by an amateur. Includes standard documentation plus a few programs, complete with keyboard, ribbon cable and Aztec modulator — only £150 ono. Phone Stevenage (0438) 53807.

Tandy TRS 80. . .4K Level II, system built into moveable Hi-Fi cabinet, with extending keyboard. Complete with technical manual and instruction books etc; also software. Offers, or exchange for Pet. Phone Hereford 3047.

OSI Superboard II. . .4K, plus PSU, cased — £300; 2K RAM, type 211 (bought for Triton but unused) — £30; Module KB 756 Professional ASCII keyboard plus data (cased) — £50; P.E. VDU, built — £60 (keyboard plus VDU — £90). Contact B. Mistry, 75 St Margaret's Road, Bradford.

Centronics 779. . .excellent condition, 9 months old, lightly used — £700 ono; also SWTPC PR 40 — £150 ono. Phone Kings Langley 62469.

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Wanted

Personal Computer World. . .Volume 1, numbers 4 and 5. Phone Mark Whidby on 061-273 7121 ext 5676 (office hours only).

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DIRECT ACCESS

FAX

The 6502 mnemonics arranged by op-code Based on information contained in "Programming the 6502" by Rodnay Zaks Published by Sybex

LSB / MSB	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
0	BRK	ORA-I, X				ORA-0-P	ASL-0-P		PHP	ORA-IMM	ASL-A			ORA	ASL		0
1	BPL	ORA-I, Y				ORA-0-P,X	ASL-0-P,X		CLC	ORA, Y				ORA, X	ASL, X		1
2	JSR	AND-I, X			BIT-0-P	AND-0-P	ROL-0-P		PLP	AND-IMM	ROL-A		BIT	AND	ROL		2
3	BMI	AND-I, Y				AND-0-P,X	ROL-0-P,X		SEC	AND, Y				AND, X	ROL, X		3
4	RTI	EOR-I, X				EOR-0-P	LSR-0-P		PHA	EQR-IMM	LSR-A		JMP	EOR	LSR		4
5	BVC	EOR-I, Y				EOR-0-P,X	LSR-0-P,X		CLI	EOR, Y				EOR, X	LSR, X		5
6	RTS	ADC-I, X				ADC-0-P	ROR-0-P		PLA	ADC-IMM	ROR-A		JMP-I	ADC	ROR		6
7	BVS	ADC-I, Y				ADC-0-P,X			SEI	ADC, Y				ADC, X			7
8		STA-I, X			STY-0-P	STA-0-P	STX-0-P		DEY		TXA		STY	STA	STX		8
9	BCC	STA-I, Y			STY-0-P,X	STA-0-P,X	STX-0-P,Y		TYA	STA, Y	TXS			STA, X			9
A	LDY-IMM	LDA-I, X	LDX-IMM		LDY-0-P	LDA-0-P	LDX-0-P		TAY	LDA-IMM	TAX		LDY	LDA	LDX		A
B	BCS	LDA-I, Y			LDY-0-P,X	LDA-0-P,X	LDX-0-P,Y		CLV	LDA, Y	TSX		LDY, X	LDA, X	LDX, Y		B
C	CPY-IMM	CMP-I, X			CPY-0-P	CMP-0-P	DEC-0-P		INV	CMP-IMM	DEX		CPY	CMP	DEC		C
D	BNE	CMP-I, Y				CMP-0-P,X	DEC-0-P,X		CLD	CMP, Y				CMP, X	DEC, X		D
E	CPX-IMM	SBC-I, X			CPX-0-P	SBC-0-P	INC-0-P		INX	SBC-IMM	NOP		CPX	SBC	INC		E
F	BEQ	SBC-I, Y				SBC-0-P,X	INC-0-P,X		SED	SBC, Y				SBC, X	INC, X		F
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	

I = indirect 0-P = page zero

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COMMUNICATION

Continued from Page 43

of the segment pattern of the initial letter of the word, from 0F12 to 0F1A (if we want the second word), or to 0F22 (if we want the third word)

We shall need 4 counters.

The message has 3 words: Counter 1 is set initially to 3 and is decremented after displaying each word.

There are 8 positions in the display: Counter 2 is set initially to 8.

To have a word in the display for a convenient period, we need to **go** through the scanning process a certain number of times. Counter 3 is set initially to this number. (20 — in hex — is a convenient value).

To have a pause of suitable duration, we need to go through a delay loop a certain number of times. Counter 4 is set initially to this number. (10 — in hex — is a convenient value).

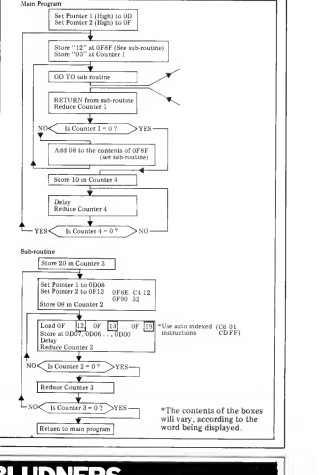
With the subroutine, during the pause which follows the third word, the last word appears in the display. If we wish to avoid this, before executing the delay loop in the main program, we can send "00" to 0D00. If the last character of the last word of the message is a full-stop, it will be displayed during the pause which precedes the repetition of the message. We may prefer this. If the last character of the last word is not a full-stop, we may wish to avoid its display during the pause. The following modification to the main program will prevent it:

```
0F5B  C4  00
0F5D  C9  01
0F5F  C4  FF
0F61  8F  FF
0F63  B8  1D
0F65  9C  F8
0F67  90  D6
```

Tom Palmer, Kew

Program for displaying words in the Mk. 14

```
Main Program
0F12  —   0F37 Reserved for the message.
0F38  00  Counter 1
0F39  C4  0D      Sub-routine
0F3B  35          0F7F  00        Counter 2
0F3C  C4  0F      0F80  00        Counter 3
0F3E  36          0F81  00        Counter 4
0F3F  C4  12      0F82  01
0F41  C8  4D      0F83  C4 20
0F43  C4  03      0F85  C8 FA
0F45  C8  F2      0F87  C4 08
0F47  C4  81      0F89  31
0F49  30          0F8A  C4 08
                  0F8C  C8 F2
0F4A  B8  ED      0F8E  C4 12
0F4C  98  09      0F90  32
0F4E  C0  40      0F91  C6 01
0F50  02          0F93  CD FF
0F51  F4  08      0F95  C4 FF
0F53  C8  3B      0F97  8F 05
0F55  90  F0      0F99  B8 E5
0F57  C4  10      0F9B  9C F4
0F59  C8  27      0F9D  B8 E2
0F5B  C4  FF      0F9F  9C E6
0F5D  8F  FF      0FA1  01
0F5F  B8  21      0FA2  30
0F61  9C  F8
0F63  90  DA
```



BLUDNERS

Sorry, all you eagle-eyes, we beat you to it. Here follows what should in fact have come at the end of this month's Systems.

Other suppliers of purchase ledger packages that we know about are:

Byte Shop	01-518 1414
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Templeman Software Services	0789 66237
Tridata Micros Ltd	021-622 1754
3-Line Computing	0482 859169

Submitting programs to PCW

Having written and thoroughly tested your original program (be it an application, a game or a useful subroutine) send it to us, along with a suitable explanation. In order of preference we would like your program submitted as a clear, dark listing on plain paper; on cassette or disc; clearly, accurately typed; or, clearly, accurately handwritten.

We pay the sender of any listing published — at least £10 and often much more — depending on the size and quality of the contribution. If the program is too large or complex for the "Programs" section we will sometimes publish it as a feature in the magazine.

It seems that PET users are in the majority . . . we get more of their programs than any others. For the sake of "balance" how about you others pitching in as well? Post your submissions to PCW Programs, 14 Rathbone Place, London W1P 1DE. We look forward to hearing from you.

380Z Pictures

by John Yale

The program is an interpreter written in BASIC for a 16K Research Machines 380Z to draw pictures on the TV screen. It should be adaptable to any computer with memory mapped display.

Commands to control the picture come from one of two sources:

1 Immediate commands from the keyboard.
2 Commands stored in DATA statements at the end of the program. The commands are an extension of those used in Reference 1.

The plotting area used is 79x47 cells. This is one cell smaller than allowed on the 380Z but provides better displays. This may be changed at line 30. When the trace goes off the screen, it reappears at the opposite side.

Initially the program is in stored program mode. Enter the number of the program stored in the data statements that is required. To add new programs, ensure that they start with "PROG" and finish with "END".

Entering zero or just 'RETURN' will switch to immediate command mode. Pushing 'RETURN' again will switch back to stored program mode.

In immediate mode, command strings are entered from the keyboard, terminated by carriage return, when they will be executed. For example, to draw a line ten units long enter 10F RETURN. To draw a square enter 4(10F2R) RETURN.

Macros may be defined using the 'D' command. e.g. D G 5F RETURN defines G to be equivalent to 5F. Macros may refer to other macros or even themselves in their definition (see PROG 1).

If a macro is redefined then the most recent definition will be used.

To view the current macros type 'LIST' in immediate mode. Note that this will restore the full screen scroller. Execute command 'C' to restore the plotting area.

Different screen sizes will produce different patterns with programs 2,3 and 4. Also try turning program 3 through 45 degrees by the immediate command 'R' before running it. These three programs will generate different patterns for hours with totally unexpected patterns appearing.

REFERENCE

Yet another body — Ken Anderson. DR DOBBS JOURNAL VOL 3 Iss 5. Some additions to Lichen Wangs Robot control language for the 8080.

```
TYPE YALE3.BAS
10 CLEAR 500
20 DIM A$(25),SI(25),SJ(25),SN(25)
30 X4=78:Y4=46:REM ** SCREEN SIZE **
40 P1=2:REM ** WHITE TRACE **
50 PI=0:PA=0:PW=0:REM ** STACK POINTERS **
60 GOSUB12J0:GOSUB1190:GOSUB1210
70 C1$="FR+- /()MTHNCJW?S="
80 INPUT "PROG NO.";P
90 IF P<>0 THEN 230
100 INPUT "ENTER COMMAND STRING";A$
110 IF A$="" THEN L1=0:GOTO30
120 IF A$<>"LIST"  THEN 180
130 REM ** LIST PROGRAM **
140 GRAPH 0
150 FOR N=1 TO L1:PRINT A$(N):NEXT
160 GOTO 100
170 REM ** EXCECUTE IMMEDIATE COMMAND **
180 IF LEFT$(A$,1)<>"D" THEN 210
190 REM ** SAVE NEW MACRO **
200 L1=L1+1:A$(L1)=A$:GOTO 100
210 N=0:GOSUB 410:GOTO 100
```

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PROGRAMS

```
220 REM ** READ PROGRAM **
230 RESTORE
240 READ A$
250 IF LEFT$(A$,4)<>"PROG" THEN 240
260 P=P-1:IF P>0 THEN 240
270 FOR L1=1 TO 25
280 READ A$
290 IF A$="END" THEN 320
300 A$(L1)=A$
310 NEXT L1
320 L1=L1-1
330 REM*EXECUTE PROGRAM**
340 FOR N=1 TO L1
350 IF LEFT$(A$(N),1)="D" THEN 380
360 A$=A$(N)
370 GOSUB 410
380 NEXT N
390 GOTO 80
400 REM **RECURSIVE SUBROUTINE TO INTERPRET A$**
410 I=1
420 M=0:AF=0
430 IF I>LEN(A$) THEN RETURN
440 C$=MID$(A$,I,1)
450 IF C$="A" THEN M=A:AF=1:I=I+1:GOTO 430
460 IF ASC(C$)<48 OR ASC(C$)>57 THEN 490
470 M=10*M+VAL(C$)
480 I=I+1:GOTO 430
490 IF M=0 AND AF=0 THEN M=1
500 REM **SEARCH COMMAND STRING**
510 FOR N1=1 TO LEN(C1$)
520 IF C$=MID$(C1$,N1,1) THEN 730
530 NEXT N1
540 REM **MUST BE MACRO**
550 GOSUB 970
560 PN=PN+1:SN(PN)=N
570 IF N=0 THEN A1$=A$:REM IMAD MODE **
580 FOR N=L1 TO 1 STEP -1
590 IF C$=MID$(A$(N),2,1) THEN 610
600 NEXT N:PRINT "NO MACRO";C$:GOTO 630
610 A$=MID$(A$(N),3)
620 IF S4(P4)<=0 THEN 650
630 GOSUB 410
640 S4(P4)=S4(P4)-1:GOTO 620
650 N=SN(PN):PN=PN-1
660 IF N>0 THEN A$=A$(N) ELSE A$=A1$
670 IF LEFT$(A$,1)="D" THEN A$=MID$(A$,3)
680 I=3I(PI)
690 PI=PI-1:PM=PM-1
700 GOTO 740
710 ON N1 GOSUB 770,880,900,910,920,930,
        960,1020,310,1110,1190,1210,1230,
        1280,1290,1040,1300,1320
720 M=M-1
730 IF M>0 THEN 710
740 I=I+1:GOTO 420
750 REM ** COMMAND SUBROUTINES **
760 REM ** FORWARD **
770 GOSUB 810
780 IF SW=0 THEN 800
790 GOSUB 1360:P1=2*(1-P2)
800 PLOT X,Y,P1:RETURN
810 X=X+DX:Y=Y+DY:REM ** MOVE **
820 IF X>XM THEN X=0
830 IF X<0 THEN X=XM
840 IF Y>YM THEN Y=0
850 IF Y<0 THEN Y=YM
860 RETURN
870 REM ** TURN RIGHT **
880 DT=DX
890 DX=SGN(DX+DY):DY=SGN(DY-DT):RETURN
900 A=A+1:RETURN:REM ** PLUS **
910 A=A-1:RETURN:REM ** MINUS **
```

PROGRAMS

```
920 RETURN:REM ** SPACE **
930 A2=A:A=A1:A1=A2:REM ** / **
940 RETURN
950 REM ** ( **
960 IF M<=0 THEN GOSUB 1130:RETURN
970 PI=PI+1:PM=PM+1
980 SI(PI)=I:SM(PM)=M
990 M=0
1000 RETURN
1010 REM ** ) **
1020 SM(PM)=SM(PM)-1
1030 IF SM(PM)>0 THEN I=SI(PI):RETURN
1040 IF SM(PM)=-100 THEN I=LEN(A$)
1050 PM=PM-1:PI=PI-1
1060 RETURN
1070 REM ** ? **
1080 I=I+1
1090 IF RND(1)>.5 THEN 1110 ELSE 1120
1100 REM ** T **
1110 I=I+1:IF A<=0 THEN 1130
1120 M=-99:GOSUB 970:RETURN
1130 B=1
1140 I=I+1:C$=MID$(A$,I,1)
1150 IF C$="(" THEN B=B+1
1160 IF C$=")" THEN B=B-1
1170 IF B=0 THEN RETURN ELSE 1140
1180 REM ** HOME **
1190 X=INT((XM+1)/2):Y=INT((YM+1)/2)
1200 PLOT X,Y,P1:RETURN
1210 DX=0:DY=1:RETURN:REM ** NORTH **
1220 REM ** CLEAR **
1230 GRAPH 1:IF P1=2 THEN RETURN
1240 FOR X1=0 TO XM STEP 2
1250 FOR Y1=0 TO YM STEP 3
1260 PLOT X1,Y1,255
1270 NEXT Y1,X1:RETURN
1280 P1=0:SW=0:RETURN: REM ** BLACK TRACE **
1290 P1=2:SW=0:RETURN: REM ** WHITE TRACE **
1300 SW=1:RETURN: REM ** SWITCH TRACE **
1310 REM ** "=",SET A TO NEXT POINT **
1320 X2=X:Y2=Y:GOSUB 810:GOSUB 1340
1330 X=P2:X=X2:Y=Y2:RETURN
1340 REM ** SUBR TO EXAMINE POINT X,Y **
1350 REM ** P2=0 OR 1 FOR OFF OR ON **
1360 XY=62656+INT(X/2)-64*INT(Y/3)
1370 GRAPH 2:P2=PEEK(XY):GRAPH 3
1380 X1=X-2*INT(X/2)+1
1390 Y1=2-Y+3*INT(Y/3)
1400 P2=P2 AND X1*INT(2^(2*Y1)+.5)
1410 IF P2<>0 THEN P2=1
1420 RETURN
1430 DATA PROG 1 HILBERT CURVE
1440 DATA DUT(-V G 6R U 2R G U G 6R V +) 6R
1450 DATA DVT(-U 2R G V G 6R V 2R G U +) 2R
1460 DATA DG3F
1470 DATA DZ HN 23F 6R 33F C F 4R U
1480 DATA A- 4+ Z
1490 DATA END
1500 DATA PROG 2 SPIRAL
1510 DATA SA-999(4(AFR)+)
1520 DATA END
1530 DATA PROG 3 SQUARE SPIRAL
1540 DATA SA-999(AF2R+)
1550 DATA END
1560 DATA PROG 4 SQUARES
1570 DATA DZ 4(AF2R)
1580 DATA DX Z 5R 21 3R 4+
1590 DATA CHN=S 999X
1600 DATA END
```

COMMAND SUMMARY

F	Move forward one cell leaving trace (B or W).	+	Increment Accumulator.
		−	Decrement Accumulator.
R	Turn right 45 degrees.	A	Current value of Accumulator.

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PROGRAMS

SPACE	No operation.
/	Exchange Accumulators A, A'.
()	Brackets used to group commands.
M	Move one cell forward without leaving trace.
T (then) else	Test if A>0 : do 'then' if A=0 : do 'else'
H	Go Home to centre screen.
N	Face North (up).
C	Clear screen (to B or W).
B	Leave Black trace.
W	Leave White trace.
? (then) else	Randomly chose 'then' or 'else'.
S	Switch trace on overlaps. This allows complex patterns to form without eventual 'white out' of the display.
=	Set Accumulator to 1 if call immediately in front is white, else set accumulator to 0.
D char commands	Define 'char' to be 'commands'. NOTE: recursive macros are allowed.
n command	Repeat 'command' n times where n is an integer or A.

EXAMPLES

A–	Set Accumulator to zero.
A– 5+	Set Accumulator to 5.
CHN =	Clear screen. Go home to centre. Face North. Set Accumulator to zero.
D% 3F 2M	Define % to be three forward, two move. NOTE: 'D' must be the first character on the line and % the second.

NOTES ON RML BASIC

1 String space must be reserved before strings are used. CLEAR 500 at line 10 reserves 500 bytes.
2 PLOT X, Y, P plots a white square at X, Y if P is 2 and a black square if P is 0.
3 GRAPH 1 restricts the scrolling display to the bottom four lines and clears a plotting area of 48 x 80.
GRAPH 0 restores the full screen scroller.
GRAPH 2 The area of memory containing the screen data is "opened" for reading by BASIC "PEEK".
GRAPH 3 The display memory is "closed" to "PEEK".

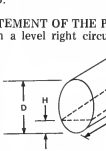
Fuel tank

by Tyrone Crudis

If you are blessed with oil-fired central heating and if your above-ground storage tank is shaped like a tin of beans lying on its side (but larger), you may have been puzzled as I was to compute the amount of fuel remaining from the measurement taken on a dipstick. This is a handy little problem to run off on a programmed calculator or micro. If you have a printer you could perhaps prepare customized tabulations for your friendly neighbourhood fuel oil co.

STATEMENT OF THE PROBLEM

Given a level right circular cylinder of diameter D and length L: to find the volume of fluid contained in it at heights H from H=0 to H=D.



SOLUTION

You won't likely find this one in the handbooks, and if your calculus is rusty, you might have a little trouble deriving it, so take my word for it! It comes with arc cosine terms which I have converted to arc tangent form for the convenience of those who have only the latter function. The language is BASIC and the graphical layout is for PET; others may adopt and adapt as desired.

Test the expression: if the answer is not zero for H=0, you've goofed. If the answer for H=D does not correspond to the nominal volume of your tank, just insert a fudge factor, C5, to compensate for its shape.

PCW suggests that the reader uses a correction factor of 1 if no "fudging" is required.

```
READY.
 90 REM  FUEL TANK   BY TYRONE CRUDIS        11.79.        GIVES VOLUME OF FLUID IN
100 REM LITERS & GALLONS VS HEIGHT H IN  INCHES FOR CYLINDRICAL TANK OF LENGTH
110 REM L INCHES AND DIAMETER D INCHES.
120 INPUT "DIAMETER IN INCHES";D:R=D/2:C1=4*R^2*90
130 IF D<>0 GOTO 150
140 PRINT"NEED MUCH DATA FOR ONE SCREEN
150 PRINT"MODIFY FORMAT BEFORE PROCEEDING." END
160 PRINT INPUT"LENGTH IN INCHES";L
170 PRINT INPUT"CORRECTION FACTOR";C5 REM CORRECTS FOR INT. VOL. VS EXT. AND
180 REM OTHER IRREGULARITIES. CHOOSE 1TTO MAKE H=D GIVE CORRECT TOTAL VOLUME.
190 REM  ***
200 C2=180/π REM RADIANS TO DEGREES.
210 C3=L*16.39/1000 REM RATIO OF VOL.IN LITERS TO AREA IN SQ.IN.
220 C4=0.22 REM LITERS TO IMP. GALS.
230 DEF FNV(H)=C3*(C1*C2*ATN(SQR(R12-(R-H)↑2)/(R-H+1E-12))-2*SQR(2*R*H-H↑2)*(R-H))/2
240 PRINT"□          FUEL TANK  VOLUME VS HEIGHT
250 PRINT "H IN.   LI.     GAL.   I IN.   LI.     GAL.
260 PRINT "
270 FOR H=0 TO INT(F) STEP 2 IF H<>F GOTO 290
280 V=INT(C3*C1*C5*45) GOTO 300
290 V=INT(FNV(H)*C5)
300 PRINT H,TAB(5);V,TAB(12);INT(V*C4),TAB(19);"!" NEXT
310 PRINT "2000" FOR H=H TO INT(2*F) STEP 2
320 V=INT(FNV(H)*C5):PRINT TAB(21);H,TAB(26);V,TAB(33);INT(V*C4)
330 IF H=2*F THEN END
340 NEXT
350 V=INT(π*R↑2*C3*C5) PRINT TAB(21);"FULL",TAB(26);V,TAB(33);INT(V*C4) END
READY.
```

Tank battle

by Kevin Jones

Here is the listing for the PET tank battle mentioned in Young Computer World this month.

```
5 REM
15 REM *** TANKS ***
25 REM ( K. JONES 25/10.79 ***
35 REM
40 PRINT "[7TANK S" PRINT
50 PRINT"THE OBJECT OF THE GAME IS TO SCORE"
60 PRINT "TEN POINTS"
70 PRINT "YOU MAY SCORE A POINT IN TWO WAYS  BY"
80 PRINT "SHOOTING YOUR OPPONENT S TANK  OR IF YOU"
90 PRINT "STEP ON A MINE *  A POINT IS SCORED FOR"
100 PRINT "MIN, A MISSILE WILL FLY OVER A MINE"
110 PRINT "AND DISINTEGRATE ON HITTING AN OUTER"
120 PRINT "WALL. IF IT HITS A BARRIER INSIDE THE"
130 PRINT "BOARD AREA. IT WILL HALF DESTROY IT. ON"
140 PRINT "THE NEXT HIT IT WILL RUIN IT TOTALLY."
160 PRINT "EACH PLAYER HAS NINE CONTROLS AS SHOWN"
170 PRINT "   E R T              7 8 9"
180 PRINT "   D F G              4 5 6"
190 PRINT "   C V B              1 2 3"
200 PRINT "TO MOVE 1 SQUARE IN ANY DIRECTION PRESS"
210 PRINT "THE KEY IN THAT DIRECTION FROM YOUR"
220 PRINT "CENTRE KEY. THE CENTRE BUTTON ITSELF"
230 PRINT "FIRES A MISSILE IN THE DIRECTION OF"
240 PRINT "YOUR LAST MOVE."
250 PRINT "THE LEFT TANK IS SHOWN AS ●."
260 PRINT "THE RIGHT TANK IS SHOWN AS O."
270 PRINT "PRESS ANY KEY TO START " A#=""
280 GET A#: IF A#="" THEN 280
290 GOSUB 900 :PRINT"[7"
300 FOR X=0 TO 39
310 POKE 32768+X,227 POKE 33568+X,228
320 NEXT X
330 FOR Y=1 TO 19
340 POKE 32768+40*Y,229 POKE 32807+40*Y,231
350 NEXT Y
360 FOR Y=1 TO 19
370 FOR X=1 TO 38
380 R=RND(1)*40
390 IF R<9.3 AND R<9.75 THEN POKE 32768+40*Y+X,160
400 IF R>9.75 THEN POKE 32768+40*Y+X,90
410 NEXT X:NEXT Y
420 LV=10 LH=3 PV=10 RH=36
430 M=32
440 POKE 33171,81 POKE 33204,87
445 REM *** SETS UP BOARD ***
450 POKE 33661-SL+48,POKE 33675,SR+48
460 IF SL=10 OR SR=10 THEN 840
470 A#=""
480 GET A#:IF A#="" THEN 480
490 IF A#="C" OR A#="1" THEN R=-1 D=1
500 IF A#="V" OR A#="2" THEN R=0 D=1
510 IF A#="B" OR A#="3" THEN R=1 D=1
520 IF A#="D" OR A#="4" THEN R=-1 D=0
530 IF A#="F" OR A#="5" THEN R=0 D=0
540 IF A#="G" OR A#="6" THEN R=1 D=0
550 IF A#="E" OR A#="7" THEN R=-1 D=-1
560 IF A#="R" OR A#="8" THEN R=0 D=-1
570 IF A#="T" OR A#="9" THEN R=1 D=-1
580 IF R=0 AND D=0 THEN 470
585 REM *** ACCEPTS CONTROL ***
590 IF ASC(A#)<60 THEN PR=R:PD=D:VPV=PV+R:PV=PV+R:S=SL:M=PM
600 IF ASC(A#)>60 THEN LR=R:LD=D:VLV=LV+R:LV=LV+R:S=SR:M=LM
604 C=32768+40*V
608 N=32768+H+R+40*(V+D)
610 IF PEEK(N)<>80 AND PEEK(N)<>90 THEN 650
620 IF PEEK(N)=32 THEN POKE C,M:M=32 POKE N,P
630 IF PEEK(N)=90 THEN POKE C,M:M=90 POKE N,P GOSUB 790:S=S+1
640 H=H+R V=V+D
650 IF ASC(A#)<60 THEN PV=V: RH=H  SL=S  RM=M
660 IF ASC(A#)>60 THEN LV=V:LH=H SP=S LM=M
670 GOTO 450
675 REM *** TANK MOVEMENT ***
680 IF A#="5" THEN V=PV  H=PH  R=PR  D=PD  O=67
690 IF A#="F" THEN V=LV  H=LH  R=LR  D=LD  O=91
700 C=32768+H+40*V
710 N=32768+H+R+40*(V+D)
720 IF PEEK(N)=32 THEN POKE C,O  POKE N,46 H=H+P  V=V+D  O=32  GOTO 700
730 IF PEEK(N)=102 THEN POKE C,O GOSUB 790  POKE N,32  GOTO 450
740 IF PEEK(N)=160 THEN POKE C,O  GOSUB 790  POKE N,102  GOTO 450
750 IF PEEK(N)=90 THEN POKE C,O  POKE N,46  H=H+P  V=V+D  O=90  GOTO 700
760 IF PEEK(N)=81 THEN SR=SR+1  POKE C,O  GOSUB 790  GOTO 450
770 IF PEEK(N)=87 THEN SL=SL+1  POKE C,O  GOSUB 790  GOTO 450
780 IF PEEK(N)>200 THEN POKE C,O GOTO 450
785 REM *** FIRING ROUTINE ***
790 Z1=PEEK(H+1)  Z2=PEEK(H-1)  Z3=PEEK(H+40)  Z4=PEEK(H-40)
800 POKE H+1,42:POKE N-1,42:POKE H+40,42
810 FOR X=0 TO 50 :NEXT X
820 POKE H+1,Z1  POKE N-1,Z2  POKE H+40,Z3  POKE H-40,Z4
830 RETURN
835 REM *** EXPLOSION EFFECT ***
840 IF SL=10 THEN A#="LEFT"
850 IF SR=10 THEN A#="RIGHT"
860 PRINT"[2WOW!THE GAME WAS WON BY THE "A#" PLAYER."
870 INPUT "WANOTHER GAME";A#
880 IF LEFT$(A#,1)="Y" THEN GOSUB 900  GOTO 290
890 END
900 A#="" R=0 D=0 SL=0 SR=0 LM=32 PM=32 RETURN
```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BELLS & WHISTLES

Large numeral generator

from a program
by E. G. Kemplen

This routine displays a large numeral as a 6 by 7 matrix of asterisks. Written for PET, it should run on other micros quite easily.

The routine sets up two arrays, A$ and A in lines 110 to 190. A$ contains the four elements used to construct the numeral, while A contains ten sets of codes used to select the appropriate element for each row.

This subroutine will work as it is because line 200 contains an instruction to input the value, X, to be displayed.

```
100 PRINT"□"
110 DIM A(70),A$(4),B$(3),S(14)
120 DATA"******"
130 DATA"*    *"
140 DATA"     *"
150 DATA"  *  *"
160 FOR I=1TO4 READ A$(I): NEXT
170 DATA1,4,4,4,4,4,1,3,3,3,3,3,1,3,3,1,2,2,1,1,3,3,1,2,3,1,4,4,4,1,3,3,3
180 DATA1,2,2,1,3,3,1,1,2,2,1,4,4,1,1,3,3,3,3,3,1,4,4,1,4,4,1,1,4,4,1,3,3,1
190 FOR I=1TO70 READ A(I): NEXT
200 INPUT "#";X PRINT"#"
240 FOR I=1TO7
250 PRINT"▮▮▮▮▮▮▮";A$(A(X*7+I))
260 NEXT
270 GOTO 200
280 REM
```

String routines

by Michael Parr

These routines were designed to run on an Altair system but are intended for any Microsoft-type system — eg Tandy, PET etc.

String Changing

A common operation when working with character strings is to change part of a string, leaving the rest unaltered. For example, to change "COMPUTOR" to "COMPUTER" the operation can be specified as replacing "TO" by "TE". If we were imprecise, and just altered "O" to "E" then the result would be "CEMPUTER".

Some versions of BASIC have a statement of the form:

CHANGE F$ TO T$ IN L$

which automatically does the replacing. One may write:

```
10 L$ = "COMPUTOR"
20 CHANGE "TO" TO "TE" IN L$
30 PRINT L$
```

where COMPUTER is printed.

This is fine, but the commonly available Microsoft BASIC does not include such a statement. However, do not despair. Fig 1 gives the listing of an equivalent subroutine. The calling sequence must set L$ to the string to be changed, F$ to the section of L$ to be changed, and T$ to the new version of F$. As an example, the above operation is performed by:

```
10 L$ = "COMPUTOR"
20 F$ = "TO" : T$ = "TE"
30 GOSUB 1200
40 PRINT L$
```

Note:

a. It is possible to delete characters by setting T$ to a zero length string, thus:
20 F$ = "A" : T$ = "" : GOSUB 1200
would remove every letter "A" from L$.

b. If F$ is not found in L$, the subroutine does not change L$. However, an error may result if an attempt is made to extend L$ beyond the maximum possible length (usually 255).

The subroutine has a variety of uses:

a. The addition of some ten lines results in a simple file editor (fig 2), which has proved useful in converting programs written for different BASIC systems, which may use for example "instead of", and may need an argument for RND, i.e. RND(1).

b. A word processing system requires the facility to alter all occurences of a word to a different word. By the inclusion of spaces in F$, one can ensure that complete words are selected for alteration, as opposed to parts of a word.

c. The routine has been used as the heart of a simple macro-processor, taking up some 80 lines of BASIC.

An INSTR Routine

Frustrated Pet users will have realised that, though their BASIC includes LEFT$, RIGHT$, and MID$, the INSTR function (which locates the position of a substring within a string) is missing. Fortunately fig 3 lists a subroutine which exactly simulates the Altair INSTR function. It has been intentionally written in "simple" BASIC to aid implementation on a range of systems.

The routine takes F as the starting position of the search, and examines L$ for an occurrence of F$. The position is set in P8, and is zero if F$ is not found.

To produce the effect of:

1230 P8=INSTR(F, L$, F$)

use:

1230 GOSUB 2000

BELLS & WHISTLES

```
1200 REM * * CHANGE F$ TO T$ IN L$ * *
1210 REM USES S$,L1,F,P8
1220 F=1
1230 P8=INSTR(F,L$,F$)
1240 IF P8=0 THEN RETURN
1250 S$=L$
1260 L1=LEN(L$)
1270 IF L$=F$ THEN L$=T$ RETURN
1280 IF P8+LEN(F$)=L1+1 THEN L$=LEFT$(L$,P8-1)+T$ GOTO 1310
1290 IF P8>1 THEN L$=T$+RIGHT$(L$,L1-LEN(F$)) GOTO 1310
1300 L$=LEFT$(L$,P8-1)+T$+RIGHT$(S$,L1-P8-LEN(F$)+1)
1310 F=P8+LEN(T$)
1320 GOTO 1240
1330 REM SUB END
```

```
10 REM FILE EDITOR
20 CLEAR 500 : ENSURE ENOUGH STRING SPACE (NOT NEEDED ON PET)
30 INPUT"WHICH FILE TO EDIT";A$
40 INPUT"NEW FILE";B$
50 REM OPEN "I"NPUT AND "O"UTPUT FILE.
60 OPEN"I",1,A$ : OPEN"O",2,B$
70 LINEINPUT#1,ALTER ALL ";F$
80 LINEINPUT#1,"TO ";T$
90 REM EDIT ALL FILE
100 IF EOF(1) THEN END
110 LINEINPUT#1,L$ : GOSUB 1200
120 PRINT#2,L$ : GOTO 100
```

```
2000 REM INSTR(F,L$,F$) . RESULT IS P8
2010 REM FS USED
2020 FS=INL(0)
2030 IF FS>0 THEN 2050
2040 PRINT"ILLEGAL USE OF INSTR " : STOP
2050 IF LEN(L$)=0 THEN 2120
2060 IF LEN(F$)=0 THEN 2120
2070 IF LEN(L$)<LEN(F$) THEN 2120
2080 IF F$<LEFT$(L$,LEN(F$))+1 THEN 2120
2090 FOR P8=F$ TO LEN(L$)-LEN(F$)+1
2100 IF MID$(L$,P8,LEN(F$)) = F$ THEN 2130
2110 NEXT P8
2120 P8=0
2130 RETURN
```

NAMING NASCOM FILES

by J. Dartnell

Although the basic NASCOM 1 (T2) Monitor is quite powerful it does not have any facilities for dumping and loading named tape files. This routine (within the confines of the memory available) is designed to provide the facility of named tape files, thus allowing several programs (particularly sub-routines) to be stored on one tape and recalled by a search. Tape positioning for cassette recorders without footage counters is also possible.

The routine is executed from 0F15 and with data areas occupies 0EF8 — 0F60. This means a file can occupy 0C50 — 0EEF and leaves 0FE1 — 0FFF available for the stack in the basic system.

There are two restrictions in its use. Firstly, dumped data cannot have an address higher than 0EEF in the basic system. Secondly, the Monitor LOAD routine will (as usual) overwrite memory with the contents of any intermediate files.

Three commands are availaole within the routine:-

1. Modify the addresses of the area of memory to be dumped, command character M.
2. Dump the area of memory specified by the addresses set up by M, command character D.
3. Load the file specified, command character L.

The maximum length of the file name is 8 bytes.

Example 1

To dump a file extending from 0C50 to 0EEF called TESTFILE.

```
>EF15 N/L
F? TESTFILE          Enter filename (8 bytes maximum) terminated
                     by full stop. Full stop is not repeated on the
                     screen.
C? M                 M — modify dump addresses. Enter M only.
0EF8 XX 50 0C F0 0E. N/L  Enter data as usual under Monitor MODIFY.
                     Note that the addresses are reversed i.e. 0C50
                     is entered as 50 0C.
C? D                 D — dump file. The cassette motor should be
                     started before entering D as the routine starts
                     the dump immediately. Any spurious characters
                     generated by switching on the cassette motor are
```


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PROGRAMS

ignored as the routine only accepts M, L or D at this stage.
>. Header dumped.
>. File dumped.
>. Finished. N.B. N/L may be required here.
>   Return to Monitor

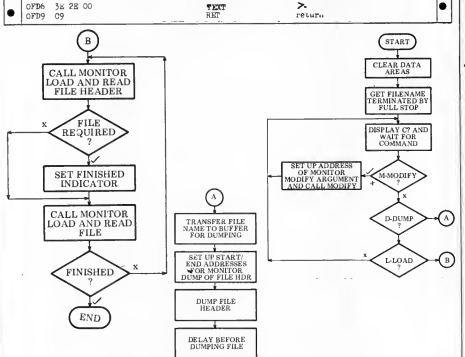
Example 2
To load a file named TEST2
>EF15 N/L
F? TEST2
C? L

Enter file name terminated by full stop.
L — load. Enter L only. Switch on motor. Monitor LOAD information with scroll if checksum incorrect.
Finished return to Monitor
>

```
0E26  XX XX                          start and end
0E2A  XX XX                          addresses for dump
0E2C  XX XX XX XX XX XX XX XX        file name
0E34  XX XX XX XX XX XX XX XX        file name dumped/
0E3C  XX XX XX XX XX XX XX XX        loaded
0E44  XX                             finished indicator
0E15  AF              FSRCH: XOR A   clear A
0E16  21 FC 0E                LD HL,0EFC   clear file name
0E19  11 FC 0E                LD DE,0EFC   buffers
0E1C  06 19                   LD B,19H     and finished
0E1E  12              CLEAR:  LD(DE),A     indicator
0E1F  13                      INC DE       areas
0E20  10 FC                   DJNZ,CLEAR
0E22  EF                      RST 40       output string
0E23  1E 46 3F 20 00          TEXT         clear screen FF@
0E28  CD 5B 00        CHAR:   CALL CHIN    get a character
0E2B  FE 2E                   CP 2E        full stop?
0E2D  28 0D                   JRZ,COMM     get command
0E2F  FE 1D                   CP,1D        backspace?
0E31  20 04                   JRZ,BACK     then backspace
0E33  77                      LD(HL),A     dump
0E34  23                      INC HL       move pointer
0E35  18 01                   JR,LCHT      display character
0E37  2B              BACK:   DEC HL       scrub character
0E38  CD 5B 01        LCHT:   CALL CHT     display character
0E3B  18 E9                   JR,CHAR      get another character
0E3D  EF 1F                   RST 40       output string,scroll
0E3F  43 3F 20 00             CT@
0E43  CD 5B 00        COMM:   CALL CHIN    get command character
0E46  FE 4D                   CP 4D        M-modify?
0E48  20 11                   JRNZ,FDUMP   try D-dump
0E4A  CD 5B 01                CALL CHT     display
0E4D  EF 1F 00        FMOD:   RST 40       output string scroll
0E50  21 F8 0E                LD HL,0EF8   start address
0E53  22 0C 0C                LD(0C0C),HL  set up modify argument
0E56  CD AD 01                CALL MODIFY  monitor modify
0E59  18 E2                   JR,COMM      get another command
0E5B  FE 44           FDUMP:  CP 44H       D-dump?
0E5D  20 31                   JRNZ ,FLOAD  try L-load
0E5F  CD 5B 01                CALL CHT     display character
0E62  21 FC 0E                LD HL,0EFC   transfer file name
0E65  11 0C 0F                LD DE 0F0C   to file name
0E68  01 08 00                LD BC,08     dump
0E6B  ED B0                   LDIR         area
0E6D  00                      NOP          padding
0E6E  00                      NOP          padding
0E6F  22 0C 0C                LD(0C0C),HL  dump Arg 1
0E72  ED 53 0E 0C             LD(0C0E),DE  dump Arg 2
0E76  CD D1 0F                CALL SDUMP   dump file header
0E79  06 FF                   LD B,FFH     D=255
0E7B  CD 35 00        DELAY:  CALL KPEL    monitor delay
0E7E  10 FB                   DJNZ,DELAY   delay for reading
                              header
0E80  2A F8 0E                LD HL,(0EF8)   set up file
0E83  22 0C 0C                LD(0C0C),HL    dump Arg 1
0E86  2A FA 0E                LD HL,(0EFA)   set up file
0E89  22 0E 0C                LD(0C0E),HL    dump Arg 2
0E8C  CD D1 0F                CALL SDUMP   dump file
0E8F  18 29                   JR,LFIN      finished
0E91  FE 4C           FLOAD:  CP 4CH       L-load?
0E93  20 A8                   JRNZ,COMM    try again
0E95  CD 5B 01                CALL CHT     display
0E98  EF 1F 00                RST 40       scroll scroll
0E9B  CD C1 0F        AGAIN:  CALL SLOAD   call load routine
0E9E  11 FC 0E                LD DE,0EFC   set up for
0EA1  21 0C 0F                LD HL,0F0C   comparing
0EA4  06 0B                   LD B,0BH     file header
0EA6  1A              COMP:   LDA,(DE)     compare
0EA7  BE                      CP A,(HL)    bytes
0EA8  20 06                   JRNZ,READ    non-match
0EAA  23                      INC HL       move
0EAB  13                      INC DE       pointers
0EAC  10 F8                   DJNZ,COMP    repeat
0EAE  36 01                   LD(HL),01    matched
0EB0  CD C1 0F        READ:   CALL SLOAD   read file
0EB3  3A 14 0F                LD A,(0F14)  load finished indicator
0EB6  FE 01                   CP A,01H     finis ed?
0EB8  20 E1                   JRNZ,AGAIN   ignore if wrong file
0EBA  EF 1F 00        LFIN:   RST 40       scroll scroll
0EBD  00                      NOP          padding
0EBE  C3 94 05                JP,PARSE     return to monitor
0EC1  21 0A 0F        SLOAD:  LD HL,0F0A   set up
0EC4  22 4B 0C                LD(0C4B),HL  return addresses
0EC7  C3 7C 05                JP LOAD      jump to load routine
```

PROGRAMS

```
OFCA  21 00 00          LD HL,00 69       restore original
OFCD  22 48 0C          LD(0C48),HL       jump
OFD0  C9                RET               return
OFD1  CD D1 03    SDUMP: CALL DUMP         monitor dump
OFD4  3E 1F             RET 40            string scroll
OFD6  36 2E 00          *EXT              >.
OFD9  C9                RET               return
```



LEISURE LINES

With J.J. Clessa

Another good response — over 80 entrants — indicates that Puzzle 4 was not all that difficult (particularly for those of you with micros, programmable calculators, or use of OPCs — that's Other People's Computers).

In fact, I judge that the hardest part of the problem was actually fitting the answers onto a postcard, as requested; we even had one or two of the giant, home made variety.

The first correct entry selected out of the bag came from Mark Domby of Christchurch in Dorset; he will be receiving through the post, the promised bottle of Bollinger extra quality, very dry, special cuvee champagne. His answers (which are not unique — in fact there are an infinite number of answers to each part of the question) are as follows:

(a=2) 105263157894736842
(a=3) 103448275862068965517241379 3
(a=4) 102564
(a=5) 102040816326530612244897959183673469387755
(a=6) 101694915254237288135593220338983050847457627118644067966
(a=7) 101449275362318840579 7
(a=8) 101265822784 8
(a=9) 101123595505617977528089887640449438202247 19

(I just hope the typesetter isn't too full of party spirit when this page is being set!)

THE QUICKIE

Okay, eyes down for a quick one (a real "cringer", I'm afraid).

Two English coins add up to 55 pence. One is NOT a 50p piece. What are they?

PRIZE PUZZLE

This month's problem shouldn't prove too difficult. Find the smallest perfect square that is also the average of two other perfect squares. In other words, find three perfect squares —

a^2, b^2 and c^2 — such that: $b^2 = \frac{a^2+c^2}{2}$

By the way, for all you smart alecs out there . . . $a \neq b \neq c$.

Answers please on a *postcard* to: Puzzle No.6, Personal Computer World, 14 Rathbone Place, London W1P 1DE. All solutions must arrive by February 12 the latest.

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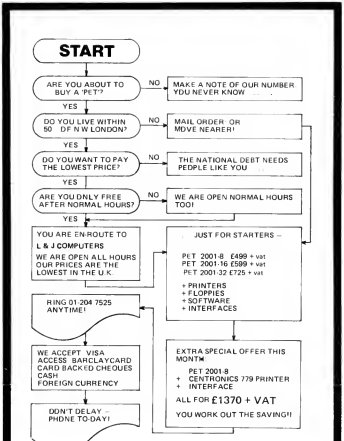

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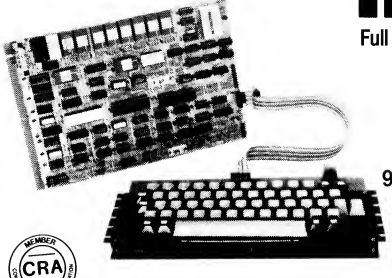

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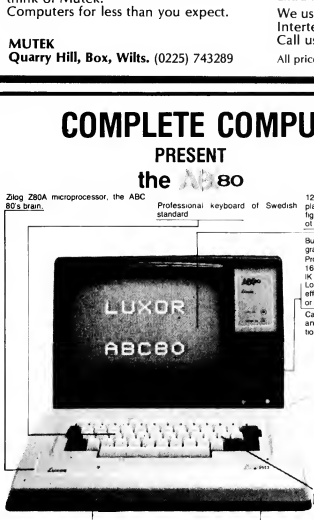

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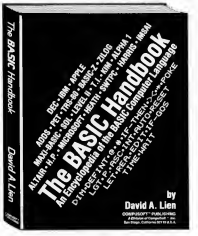

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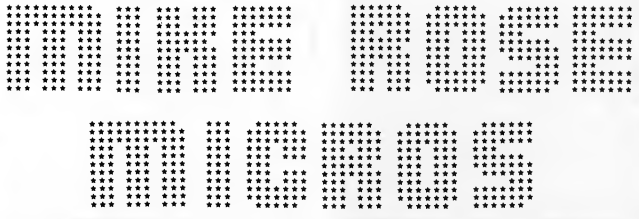

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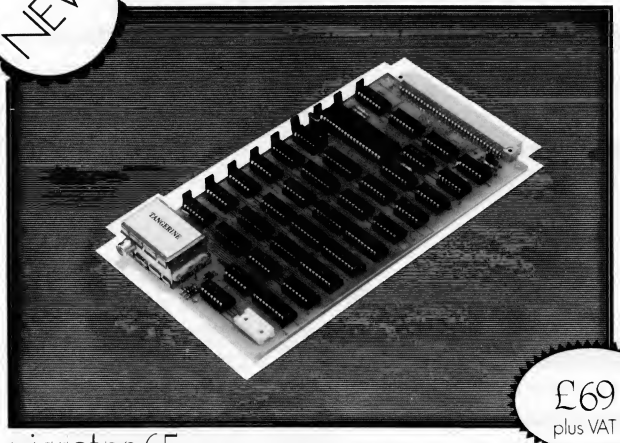

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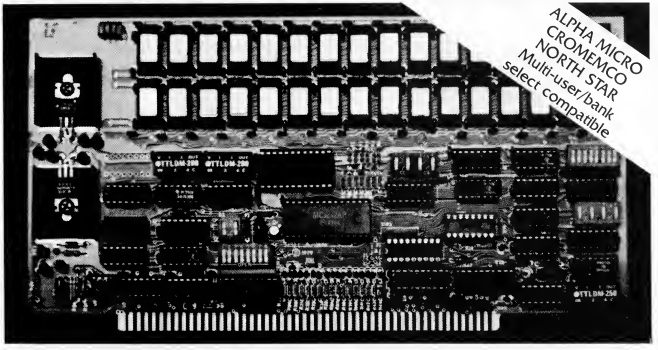

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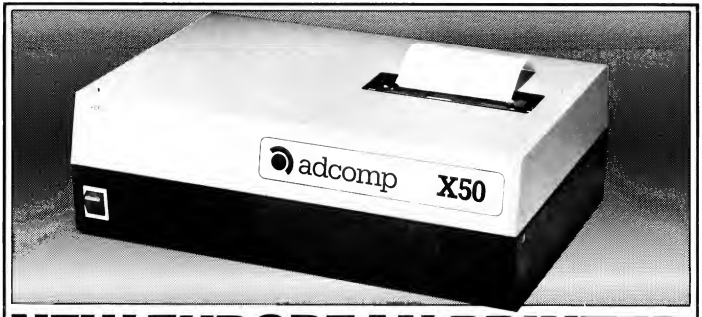

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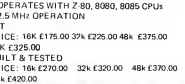

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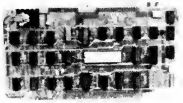

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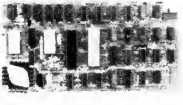

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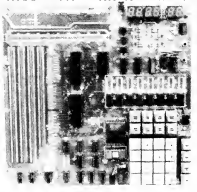

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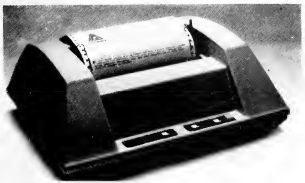

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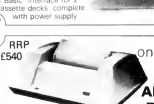

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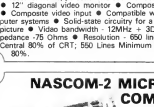

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FREE 5V POWER SUPPLY

Microprocessors Z80A 8 bit CPU. This will run at 4MHz but is selectable between 1/2/4 MHz. This CPU has now been generally accepted as the most powerful, 8 bit processor on the market.

INTERFACE

Keyboard New expanded 57 key Licon solid state keyboard especially built for Nascom. Upper & lower case. Nascom, monitor controlled, decoding.

T.V. The tv peak to peak video signal can drive a monitor directly and is also fed to the on board modulator to drive the domestic T.V.

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The cassette interface is Kansas City standard at either 300 or 1200 baud. This is a link option on the NASCOM-2.

The RS232 and 20mA loop connector will interface directly into any standard teletype.

The input and output sides of the UART are independently switchable between any of the options.

i.e. it is possible to house input on the cassette and output on the printer.

PIO There is also a totally uncommitted Parallel I/O (MK3881) giving 16, programmable, I/O lines. These are addressable as 2 x 8 bit ports with complete handshake controls.

Documentation Full construction article is provided for those who buy a kit and an extensive software manual is provided for the monitor and Basic.

Basic The Nascom 2 contains a full 8K Microsoft Basic in one ROM chip with additional features like DEEK, DOKE, SET, RESET for simple programming.

With free 16K RAM board

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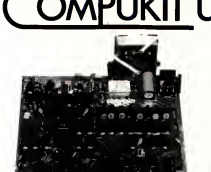

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This machine is ideal to the computing student or Maths student, ideal to teach your children arithmetic, and is also great fun to use.

Because of the enormous volume of users of this kit we are able to offer a **new reduced price** of **£199** + VAT

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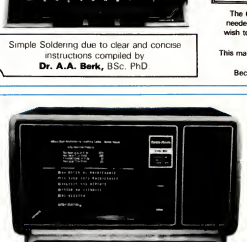

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